

CORNELL  
UNIVERSITY  
LIBRARY



BOUGHT WITH THE INCOME  
OF THE SAGE ENDOWMENT  
FUND GIVEN IN 1891 BY  
HENRY WILLIAMS SAGE

BF133 .E15 1908

**Psychology: an elementary text-book. Tra**



3 1924 029 211 286

olin

## DATE DUE

~~APR 6 1981~~

JUL 04 1968

Interlibrary  
Loan

**GAYLORD**

PRINTED IN U.S.A.



Cornell University  
Library

The original of this book is in  
the Cornell University Library.

There are no known copyright restrictions in  
the United States on the use of the text.





# PSYCHOLOGY

## AN ELEMENTARY TEXT-BOOK

BY

HERMANN EBBINGHAUS

PROFESSOR OF PHILOSOPHY IN THE UNIVERSITY OF HALLE; AUTHOR OF  
"ÜBER DAS GEDÄCHTNIS," "GRUNDZÜGE DER PSYCHOLOGIE," ETC.;  
EDITOR OF THE "ZEITSCHRIFT FÜR PSYCHOLOGIE"

TRANSLATED AND EDITED BY

MAX MEYER

PROFESSOR OF EXPERIMENTAL PSYCHOLOGY  
IN THE UNIVERSITY OF MISSOURI



BOSTON, U.S.A.

D. C. HEATH & CO., PUBLISHERS

1908

1

92

22/11/09

BF

133

E 15

1908

COPYRIGHT, 1908,  
BY D. C. HEATH & CO.

A. 233470

Sage.



## TRANSLATOR'S PREFACE

THE present book is a free translation of Ebbinghaus's "Abriss der Psychologie" (Veit & Co., Leipzig, 1908). It is intended primarily to serve as a text-book for college students, but it should appeal also to the general reader. It will commend itself through its brevity and the excellent proportions of the material selected. The translator became interested in this book because of the fact that the author has succeeded in keeping entirely free of all fads, and has presented only that which is generally accepted by psychological science; on the other hand, he has given to the highest constructive processes of the human mind, religion, art, and morality, the attention which they deserve because of their tremendous importance for human life.

In some places the original text has been somewhat condensed, particularly in the description of the anatomy of the nervous system in section 2. Section 4 of the original has been omitted, since its contents seemed to be sufficiently emphasized in the other sections of the book. The numbers of the following sections differ, therefore, from those of the German text. The translator regards this as insignificant, since his intention is not to aid his brother-psychologists in making themselves acquainted with Ebbinghaus's views, — for this end they are referred to the German original, — but to furnish an elementary text-book for the English-speaking student. Wherever there was any doubt as to the comprehensibility to the American student of any application or illustration of the laws discussed by

the author, the translator has unhesitatingly sacrificed the interest of the professional psychologist to that of the beginner-student. In a few places he has made slight additions to the original; for instance, figures 7, 8, and 9 are his own property. But he has decided to abstain from enumerating all changes, since this would be of interest only to the professional psychologist. In no case are his additions opposed to the author's views.

The questions added to each section are not exercises to be worked out by the student or puzzles to be solved by the general reader. They are intended to serve as an aid to the intelligent perusal of the book, by directing the reader's attention to the essential contents of each section.

M. M.

# CONTENTS

## INTRODUCTION

A SKETCH OF THE HISTORY OF PSYCHOLOGY . . . .	PAGE 3
---	-----------

## CHAPTER I

### GENERAL PSYCHOLOGY

§ 1. BRAIN AND MIND . . . . .	27
§ 2. THE NERVOUS SYSTEM . . . . .	30
1. The Elements of the Nervous System . . . . .	30
2. The Architecture of the Nervous System . . . . .	34
3. The Anatomy of the Nervous System . . . . .	38
4. The Nervous System and Consciousness . . . . .	41
§ 3. EXPLANATION OF THE FUNCTIONAL RELATION BETWEEN BRAIN AND MIND . . . . .	43
1. The Brain a Tool of the Mind . . . . .	44
2. The Brain an Objectified Conception of the Mind . . . . .	47

## CHAPTER II

### THE SPECIAL FACTS OF CONSCIOUSNESS

#### *A. The Elements of Mental Life*

§ 4. SENSATION . . . . .	50
1. The Newly Discovered Kinds of Sensation . . . . .	50
2. The Other Sensations . . . . .	57
3. Temporal and Spatial Attributes . . . . .	65
4. Sensation and Stimulus . . . . .	69
§ 5. IMAGINATION . . . . .	78
§ 6. FEELING . . . . .	81
§ 7. WILLING . . . . .	85

*B. The Fundamental Laws of Mental Life*

	PAGE
§ 8. ATTENTION . . . . .	87
§ 9. MEMORY . . . . .	93
§ 10. PRACTICE . . . . .	99
§ 11. FATIGUE . . . . .	102

*C. The Expressions of Mental Life*

§ 12. PERCEPTION AND MOVEMENT . . . . .	105
§ 13. THOUGHT AND MOVEMENT . . . . .	108

## CHAPTER III

## COMPLICATIONS OF MENTAL LIFE

*A. The Intellect*

§ 14. PERCEPTION . . . . .	114
1. Characteristics of Perception . . . . .	114
2. Illusions . . . . .	120
§ 15. IDEATION . . . . .	123
§ 16. LANGUAGE . . . . .	128
1. Word Imagery . . . . .	128
2. The Acquisition of Speech . . . . .	130
3. The Growth of Language . . . . .	135
4. The Significance of Language . . . . .	139
§ 17. JUDGMENT AND REASON . . . . .	142
1. Coherent Thought . . . . .	142
2. The Self and the World . . . . .	145
3. Intelligence . . . . .	148
§ 18. BELIEF . . . . .	152

*B. Affection and Conduct*

§ 19. COMPLICATIONS OF FEELING . . . . .	162
1. Feeling Dependent on Form and Content . . . . .	162
2. Feeling Dependent on Association of Ideas . . . . .	164
3. Irradiation of Feeling . . . . .	167
§ 20. EMOTIONS . . . . .	168
§ 21. COMPLICATIONS OF WILLING . . . . .	173
§ 22. FREEDOM OF CONDUCT . . . . .	176

## CHAPTER IV

## HIGHEST ACCOMPLISHMENTS OF CONSCIOUSNESS

	PAGE
§ 23. EVILS OF KNOWLEDGE . . . . .	183
§ 24. RELIGION . . . . .	189
§ 25. ART . . . . .	196
§ 26. MORALITY . . . . .	204
CONCLUSION . . . . .	210
INDEX . . . . .	213

## ILLUSTRATIONS

	PAGE
Multipolar Cell Body . . . . .	30
Pyramidal Cell Body . . . . .	31
Dendrites of a Nerve Cell of the Cerebellum . . . . .	31
Various Types of Cell Bodies . . . . .	32
Longitudinal Section of a Nerve Fiber with Stained Fibrils . . . . .	32
Terminal Arborization of Optical Nerve Fibers . . . . .	33
Diagram of Nervous Architecture: Reflex Arches connected by a Low Nerve Center . . . . .	36
Diagram of Nervous Architecture: Lower Nerve Centers con- nected by a Higher Center . . . . .	36
Diagram of Nervous Architecture: Higher Nerve Centers con- nected by a Still Higher Center . . . . .	37
Frontal Section of the Right Cerebral Hemisphere . . . . .	39
Sections of the Cerebral Cortex . . . . .	40
Localization of Peripheral Functions in the Cerebral Cortex . . . . .	41
Color Pyramid . . . . .	59
"A Burnt Child fears the Fire" . . . . .	111
Two Possibilities of Perception . . . . .	120
Varieties of Perception . . . . .	121
Visual and Kinesthetic Control of Voluntary Action: the Former Intact, the Latter Lost . . . . .	175

**PSYCHOLOGY**  
**AN ELEMENTARY TEXT-BOOK**





# PSYCHOLOGY

## INTRODUCTION

### A SKETCH OF THE HISTORY OF PSYCHOLOGY

PSYCHOLOGY has a long past, yet its real history is short. For thousands of years it has existed and has been growing older ; but in the earlier part of this period it cannot boast of any continuous progress toward a riper and richer development. In the fourth century before our era that giant thinker, Aristotle, built it up into an edifice comparing very favorably with any other science of that time. But this edifice stood without undergoing any noteworthy changes or extensions, well into the eighteenth or even the nineteenth century. Only in recent times do we find an advance, at first slow but later increasing in rapidity, in the development of psychology.

The general causes which checked the progress of this science and thus made it fall behind the others can readily be stated:—

“The boundaries of the Soul you cannot find, though you pace off all its streets, so deep a foundation has it,” runs a sentence of Heraclitus, and it hits the truth more fully than its author could ever have expected. The structures and functions of our mental life present the greatest difficulties to scientific investigation, greater even than those presented by the phenomena, in many respects

similar, of the bodily life of the higher organisms. These structures and processes change so unceasingly, are so fleeting, so enormously complex, and dependent on so many factors hidden yet undoubtedly influential, that it is difficult even to seize upon them and describe their true substance, still more difficult to gain an insight into their causal connections and to understand their significance. We are just now beginning to recognize the full force of these difficulties. Wherever in recent years research in any of the many branches of psychology has made any considerable advance, — as in vision, audition, memory, judgment, — the first conclusion reached by all investigators has been, that matters are incomparably finer and richer and fuller of meaning than even a keen fancy would previously have been able to imagine.

There is, besides, a second obstacle. However difficult it may be to investigate the nature and causal connections of mental phenomena, everybody has a superficial knowledge of their external manifestations. Long before these phenomena were considered scientifically, it was necessary for practical human intercourse and for the understanding of human character, that language should give names to the most important mental complexes occurring in the various situations of daily life, such as judgment, attention, imagination, passion, conscience, and so forth ; and we are constantly using these names as if everybody understood them perfectly. What is customary and commonplace comes to be self-evident to us and is quietly accepted ; it arouses no wonder at its strangeness, no curiosity which might lead us to examine it more closely. Popular psychology remains unconscious of the fact that there are mysteries and problems in these complexes. It loses sight of the complications because of the simplicity of the names.

When it has arranged the mental phenomena in any particular case under the familiar designations, and has perhaps said that some one has "paid attention," or has "given free rein to his imagination," it considers the whole matter explained and the subject closed.

Still a third condition has retarded the advance of psychology, and will probably long continue to do so. Toward some of its weightiest problems it is almost impossible for us to be open-minded; we take too much practical interest in arriving at one answer rather than the other. King Frederick William I was not the only person who could be persuaded of the danger of the doctrine that every mental condition is governed by fixed law, and that in consequence all of our actions are fully determined — a doctrine fundamental to serious psychological research. He believed that such a teaching undermined the foundations of order in state and army, and that according to it he would no longer be justified in punishing deserters from his tall grenadiers. There are even to-day numerous thinkers who brand such a doctrine dangerous. They believe that it destroys all possibility of punishment and reward, makes all education, admonition, and advice meaningless, paralyzes our action, and must because of all these consequences be rejected.

In a similar way the discussion of other fundamental questions, such as the real nature of mind, the relation of mind and body in life and death, becomes prejudiced and confused on account of their connection with the deepest-rooted sentiments and longings of the human race. In recent years this has been the case especially in connection with the question of the evolution of mental life from its lower forms in the animals to its higher in man. What ought to be taught and investigated on its own merits as

pure scientific theory, as the probable meaning of experienced facts, comes to be a matter of belief and good character, or is considered a sign of courageous independence of spirit and superiority to superstition and traditional prejudice. All of this is quite comprehensible when we consider the enormous practical importance of the questions at issue. Yet such an attitude will scarcely be of much help in finding answers most correct from a purely objective standpoint; it rather discourages the advance of research along definite lines.

Nevertheless, as we have stated in the beginning, psychology has now entered upon a positive development. What favorable circumstances have made it possible to overcome, at least in part, the peculiar opposing difficulties?

There are many; but in the end they all lead back to one: the rise and progress of natural science since the sixteenth century. However, this has made itself felt in two quite different ways; the force of the first wave was increased to its full magnitude by a closely following second wave. First, natural science served—if we overlook the hasty identification of mind and matter which had its origin in natural science—as a shining and fruitful example to psychology. It suggested conceptions of mental life analogous to those conceptions which had been found to make material processes comprehensible. It led to attempts at employing methods similar to those which had proved valuable in natural science. This influence was especially active in the seventeenth and eighteenth centuries, and lasted into the nineteenth. Later a more direct influence began to make itself felt: an actual invasion by natural science of special provinces of psychology. Natural science, in the course of its

further development, was led at many points into investigations which lay as well in the sphere of psychology as in its own prescribed paths. When it attacked them and worked out beautiful solutions for them, psychologists also received a strong impulse not to stand aside, but to take up those problems themselves and pursue them independently for their own quite different purposes. So it was in the nineteenth century, especially in its second half.

Let us discuss more in detail a few particular results of this twofold general influence.

As the first important fruit of that indirect advancement through analogy, may be instanced the idea of the absolute and inevitable subjection to law of all mental processes, which I have just said forms the foundation of all serious psychological work. This was a familiar idea as far back as the later period of ancient philosophy, but was afterwards repudiated by the theological representatives of philosophy and psychology in the Middle Ages. To be sure, they always felt more or less attracted toward this view on account of the doctrine of the omnipotence and omniscience of God. For if God is almighty, then there can be no event in the future, either in the outer world or in the heart of man, which does not depend entirely on him; and if he is also all-knowing, or if in the eternity of God the human differences of past and future altogether disappear, then the future must be already known to God, and in consequence be fixed unalterably. But in spite of this argument, these medieval thinkers felt bound to affirm a spiritual freedom (that is, a merely partial determination) under the pressure of popular psychological and ethical thought and in consequence of their contemplation of the holiness and justice of God. For how could God have willed the sinful deeds of man,

or have caused them, even indirectly? Or how could he punish men for doing things which they were compelled to do by unalterable laws which he himself had made? Although, so it was argued, man had his origin in God, he was nevertheless not absolutely bound by the divine within him; he could turn away from it voluntarily, that is, causelessly.

The influence of the rising natural science led to the opposite answer to the question as to whether the basis of our responsibility is spiritual freedom or universal causation. Hobbes and Spinoza became the champions of universal causation, presenting their answer to the question with a clearness and incisiveness imposing even to-day. Leibniz too adopted it, but took care not to offend those holding to the other view. It has never been lost again from psychology. These men teach that the phenomena of the mental life are in one respect exactly like those of external nature, with which they are indeed closely connected: at any moment they are definitely fixed through their causes, and cannot be otherwise than as we actually find them. Freedom of action in the sense of causelessness is an empty concept. It follows from this that one can properly mean by freedom of action only that there is no compulsion from without, that the action of a thing or being is determined only by its own nature, its own indwelling properties. We say of water that it flows along freely if it is not checked by rocks or dams; or of a horse, that it runs about freely, if it is not tied up or locked in a stall. We can in this sense call the good deeds of a person or his living together with other people his own free action, if it springs from his own deliberations and desires and is not coerced by force or threats. Nevertheless all these manifestations, the

flowing, the running about, and also the good actions, are alike the regular effects of definite causes.

What constantly prevents men from recognizing this causality and leads them to a belief in a misinterpreted freedom, is solely their ignorance. Out of the multitude of motives for their actions they see, in most cases, only a single one; and if the action which takes place does not correspond with it, they are convinced that the decision occurred without cause. "A top," says Hobbes, "which is spun by boys and runs about, first towards one wall then towards another, would think, if it perceived its own motion, that it moved about by the exercise of its own will, unless it happened to know what was spinning it." In the same way people apply for a job or try to make a bargain and think that they do this by their own wills; they do not see the whips by which their wills are driven. In order to understand correctly the thoughts and impulses of man, we must treat them just as we treat material bodies, or as we treat the lines and points of mathematics. The pretended dangers of such a conception of things disappear, as soon as we face them without prejudice and try to understand them. The conception may be misused, especially by people of immature mind, but "for whatever purpose truth may be used, true still remains true," and the question is not, "what is fit to be preached, but what is true."

Supported by this view of a universal determination of mental activity, there has arisen the idea of a special determination, likewise copied from natural science. The coming and going of our thoughts is ordinarily considered as an unregulated play, defying calculation. That order rules even here, that the train of thought is governed by similarity to the mental states just present, or by a previous

connection with these mental states, was clearly recognized and expressed even in the times of Plato and Aristotle. Yet this had remained merely the knowledge of a curiosity ; no theoretical use whatever was made of it. Now it was brought into connection with newly recognized physical facts. This determination of the trains of thought depends, according to Hobbes, on the fact that our ideas are connected with material movements within the nerves and other organs, and that these movements, when once started, cannot immediately cease, but must gradually be consumed by resistance. The laws of association are to him in the spiritual sphere, what the law of inertia is in the physical. To Hume, a hundred years later, they depend on a kind of attraction, an idea suggested by Newton's law of gravitation. And since inertia and attraction had been recognized as the most important and fundamental causes of material processes, it was a natural thing to regard the laws of association, which had been compared with them, as the fundamental phenomena of mental life, and to derive from them as manifold and important consequences as had been done in the case of the physical world. So arose the English associational psychology. It attempted to explain the traditional faculties of the mind, such as memory, imagination, judgment, and also the results of their combined activity (for instance, the consciousness of self and of the outer world) as natural and, so to speak, mechanical effects of the laws of association governing the processes of mind. No doubt this attempt, appearing also in a somewhat different form in the sensationalism of France, represents, in spite of its one-sidedness, a very great advance over the psychology of the past.

Just as associationism corresponds to the explanatory natural science of Galileo and Newton, the empirical psy-



chology of the German enlightenment corresponds to the descriptive science of Linnæus and Buffon. But aside from a few exceptions, such as Tetens, its work must be regarded as a failure. To be sure, its intention is also to explain mental phenomena, to comprehend them first by careful introspection, and then to find by analysis the simplest faculties from which they have sprung. But its actual accomplishment does not go beyond a mere description of the occurrences offering themselves to first observation. And the results reached teach impressively that description is an unfruitful task unless, as sometimes of late, it is made to include also explanation. The numerous different expressions of mind, already distinguished by popular psychology, are only arranged in certain groups beside and above each other, and the explanation consists in presenting each expression as the effect of a special faculty. Thus we obtain a great multitude of complicated mental performances, inwardly related to each other, which are made to stand on a footing of equality and perfect independence, for example, perception, judgment, reason, imagination, and also abstraction, wit, symbolism, and so on. Like mere little *homunculi* in the large *homo*, they act now in harmony, now in opposition. The poetic faculty, for example, "is a coöperation of imagination with judgment." In connection with reason, imagination produces foresight. "Wit often does harm to judgment, and leads it to false verdicts. . . . Judgment must therefore be constantly on its guard against wit." The advancement in this case did not result from a development of these views, but from their overthrow. But the opposition raised was turned also against associationism.

Of the defects of associationism this is the greatest: it gives no explanation of the phenomenon of attention. The

peculiar fact that of a great number of conscious impressions or ideas simultaneously offered to the mind, only a few can ever be carried through and become effective, is not to be explained on the basis of the associative connection of ideas. The associationists pass over this important fact either with complete silence or with a very insufficient treatment, and thus put a weapon into the hands of their opponents. The mind seems, in fact, in the case of attention to mock at all attempts at explanation and to prove itself, quite in the sense of the popular conception, a reality separable from its own contents — standing face to face with them, and treating them capriciously now in one way, now in another.

It is the chief service of Herbart to have recognized a weak point here, and to have attempted to remedy it. "The regularity of the mental life," he is convinced, "is fully equal to that of the movements of the stars." Physical analogies guide him in his attempt at explanation. He regards ideas as mutually repellent structures, or, as it were, elastic bodies, assigned to a space of limited capacity, forced together and made smaller by mutual pressure, but never annihilating each other. If several ideas are simultaneously called forth, they become conflicting forces, on account of the unity of the mind, in which they are compelled to be together, and on account of the opposition which exists among them. In this struggle their clearness suffers and their influence on consciousness is impaired. However, they do not perish, but become, to the extent that they suffer, latent forces.

As soon as the opposing factors lose their strength these latent forces emerge again into full consciousness out of the obscurity in which they have been buried. After making some further simple assumptions as to the strength

of these interferences, Herbart concludes that two ideas are sufficient to crowd a third completely out of consciousness. To his great satisfaction he thus gains from the consideration of a simple mechanism "a solution of the most general of all psychological problems." By this problem he means the fact that of all the knowing, thinking, wishing, which at any moment might be brought about by the proper causes, only a very small part plays a significant rôle, while the rest is not really lost. That is, he means the fact of attention. But this principle of the mutual interference of ideas is not the only one he uses. The second principle upon which his theory is based is that of association. With these two weapons he takes up the fight against the faculty psychology, and carries it to a successful end. He believes that all those activities traditionally placed side by side, even feeling and desire, can be made comprehensible as results of the mechanics of ideas.

Yet Herbart seeks by still another means to "bring about a mental science similar to the natural science: . . . by quantitative methods and the application of mathematics." We find here and there before this time the idea of advancing psychology by such means. The brilliant results produced in natural science by measurement and calculation readily suggested the idea that something similar might be done for psychology. But the philosophical thinkers interested in psychology did not find the right tools; they justified their inability by asserting that such an undertaking was impossible. The most famous is the denial by Kant that mathematics can be applied to the inner mental life and its laws, because time, within which the mental phenomena would have to be represented as occurring, has but one dimension. To be sure Herbart

is not actually the pioneer in this field: he never gave a single example of how a measurement of a mental process was to be taken. However, he at least recognized that the mental life is open to quantitative treatment, not only with regard to time, but also in other respects. And in attempting to solve problems quantitatively, through the statement of numerical assumptions and their logical development to their consequences, he so strongly emphasized a side of the matter which had previously been wholly neglected, that more correct ways of clearing it up were soon found.

A strong and enduring influence was exerted by Herbart, yet the further progress of psychology did not occur along the path marked out by him. Many of his general assumptions, particularly those upon which his calculations are based, were entirely too vague to appear probable merely because a few of their consequences agreed with experience. Besides, a strong opposition had arisen against the intellectualism supported by him and by the associationists, — against the almost exclusive regard for the thinking and knowing activities of the mind. If mental life is really nothing but a machinery of ideas, a co-operation and opposition of masses of ideas, what is such a thing as religion? Is it a small complex of true and rational ideas, to which is added a large complex of superstitious fables, invented, or at any rate cultivated, by priests and princes, in order to keep men under their authority? So low a valuation of religion is scarcely possible. Or, what is art? Are the lyric poems of Goethe or the symphonies of Beethoven really only institutions for the conveyance of knowledge through the senses, as the name *aesthetics* indicates, or for the unsuspected instilling of ideas which make men more virtuous or more patriotic?

Certainly one thing which stands in the center of all mental life seems entirely incomprehensible as the result of a mere mechanics of ideas, that is, that unity of mind without which we could not speak of personality, of character, of individuality, without which we could not call one man haughty and another humble, one good and another bad, one noble and another base. Because of this weakness in the theory numerous great thinkers, Rousseau, Kant, Fichte, Schopenhauer, raised their voices to insist upon the significance of the life of feeling and will as well as of the life of ideas, even to give to the former the first place, as the expression of mind's most real inner being. Thus intellectualism was opposed by what we now call voluntarism.

This transferring of the conceptions of natural science to psychological research, in spite of the mighty impulse it gave to psychology, was not without its disadvantage. The first brilliant advances in natural science were in the province of physics, especially of mechanics. It is no wonder, then, that psychologists, in their gropings after something similar, turned first to mechanical-physical processes. Inertia, attraction, and repulsion, as we have seen, aggregation and chemical combination, were the categories with which they worked. No wonder, either, that facts were often distorted and their comprehension made difficult. For if mind is a machine, it is certainly not such a machine as even the most ingeniously constructed clock or as a galvanic battery. It is bound up with the organic body, especially with the nervous system, and on the structure and functions of the nervous system its own existence and activity somehow depend. So, if one wishes to use material analogies and to make them fruitful for the comprehension of mental structures, they must be

taken from organic life, from biology rather than from physics and chemistry. We may find phenomena comparable to individuality and character, to the mind's feeling and willing, in the unitary existence of every plant and animal organism, in the peculiar determination of its instinct of life and in the many special branches into which this instinct ceaselessly unfolds. And indeed the specifically mechanical categories gradually disappeared from psychology during the nineteenth century, and made way for the biological categories—reflex, inhibition, practice, assimilation, adaptation, and so on. Especially that great acquisition of modern biology, the theory of evolution, was at once seized upon by psychologists, and was utilized for gaining an understanding of the processes as well in the mind of the individual as in human society.

But side by side with such advances, springing from analogy and adaptation, there arose in the nineteenth century another and more direct influence of natural science, as previously mentioned. In its natural progress scientific research came to touch upon psychological problems at several points, and since it laid hold of them and followed them out for its own ends, it immediately became a pioneer for psychology.

The first and at the same time the strongest of these impulses came from the advance of the physiology of the senses. In the fourth decade of the nineteenth century remarkably active and fruitful work in this field began. Physiologists and physicists vied with each other in accurate study of the structure and functions of sense organs. Naturally they were not able to stop at the material functions in which they were most directly interested. They could not forbear to draw into the circle of their investigations those mental functions mediated by the physiolog-

ical functions and explainable on a physiological basis. The eye, especially, attracted scores of investigators, both because it is very richly endowed with dioptric and mechanical auxiliary apparatus and because it is particularly important on account of the delicacy and diversity of its functions. Yet cutaneous sensations and hearing were not neglected.

Johannes Müller, E. H. Weber, Brewster, and above all — especially versatile, far-seeing, and inventive — the somewhat younger Helmholtz, are only a few of the most noteworthy representatives of this class of research. They brought to psychology results such as it had never known before — results resting on well-conceived and original questions as to the nature of things, and on skillful attempts at arranging the circumstances for an answer, that is, on *experiment* and when possible on exact *measurement* of the effects and their causes. When Weber in 1828 had the seemingly petty curiosity to want to know at what distances apart two touches on the skin could be just perceived as two, and later, with what accuracy he could distinguish between two weights laid on the hand, or how he could distinguish between the perception received through the muscles in lifting the weights and the perception received through the skin, his curiosity resulted in more real progress in psychology than all the combined distinctions, definitions, and classifications of the time from Aristotle to Hobbes. The surprising discovery of hitherto unknown sense organs, the muscles and the semicircular canals, was made at that time, although not thoroughly verified until later. That discovery meant not only an increase of knowledge, but also a widening of the horizon, since the most conspicuous peculiarity of these organs is that they do not, like the others, bring to our consciousness external

stimuli in the ordinary sense, but processes on the inside of the body.

One result in particular of these investigations in the physiology of the senses became the starting point of a strong new movement. The course of biology in the second quarter of the nineteenth century was toward methodical and exact study of empirical facts, and away from speculation in the philosophy of nature. But for some time this exact study and this speculation were often to be found combined in the same men. Fechner was one of these. On the one hand he was a speculative philosopher, a follower of Schelling's philosophy of nature, a disciple of Herbart in his attempt at applying mathematics to psychology. So we find him speculating as to what might be the exact relations between body and soul, seeking for a mathematical formulation of the dependence of the corresponding mental and nervous processes. One October morning in 1850, while lying in bed, he conceived a formula which seemed to him plausible. In spite of this speculative tendency he was a physicist of scientific exactness, accustomed to demand a support of facts for such plausible formulas, ready to attack problems not only with his mind, but also with his hands. In following up his speculations he came across some of the results of the work of Weber. By the use of more exact methods and by long-continued series of experiments he carried Weber's investigations farther, at the same time utilizing the observations of others to which no one had before paid any attention. He succeeded in formulating the first mathematical law of mental life, Weber's law as he called it, according to which an increase of the external stimulus in geometrical progression corresponds to the increase of the mental process in arithmetical progression. (We shall



discuss this law in § 4.) He classed together all of his speculations, investigations, formulations, and conclusions as a new branch of knowledge, Psychophysics, "the scientific doctrine of the relations obtaining between body and mind."

Fechner's work called forth numberless books and articles, confirming, opposing, discussing it, or carrying its conclusions still further. The chief question which they discussed, the question whether the law formulated by Fechner was correct or not, has gradually lost its importance, and made way for other problems. Quite aside from this question, which originally formed the center of interest, Fechner's work has made itself felt in three different ways. Herbart's mathematical fiction of the combat among ideas had made such an impression upon the thinkers of the time, that — incredible as it may seem — as late as 1852 Lotze confessed that he would prefer it to formulas found by experiment. For this fiction Fechner substituted a scientific law derived from actual measurement of physical forces. Further, he gave to these facts their proper place in a broad system, showed their significance for the deepest psychological problems, and thus compelled even those psychologists who had affiliated themselves with philosophy and had previously remained unaffected by the physiology of the senses, to take notice of the new movement in their science. And finally, he worked out a methodical procedure for all psychophysical investigations, which was far superior to the methods then employed by psychologists and which continues to be of great use for the study of sensation and perception.

At about the same time, in the sixties, psychology received a third kind of impulse. Although weaker than the two just mentioned, it contributed not a little toward

increasing the number of psychological problems to which experimental methods could be applied.

In the year 1796 the Reverend Nevil Maskelyne, director of the Greenwich observatory, noticed that the transits recorded by his assistant, Kinnebrook, showed a gradually increasing difference from his own, finally amounting to almost a full second. He suspected his assistant of having deviated from the prescribed method of observation, the so-called eye and ear method, and of having substituted some unreliable method of his own. He admonished the young man to return to the correct method and do better in the future. But his admonition was in vain, and he found himself obliged to part with his otherwise satisfactory assistant. Kinnebrook lost his position on account of the deficient psychological knowledge of his time. It was not until two decades later that Bessel discovered that such differences between the results of observations by different individuals were quite general and normal, and that in Kinnebrook's case they were only unusually great. They depend on the manner of giving attention to both the sound of the pendulum and the sight of the moving star, which naturally differs in different individuals.

At first this question of the so-called personal equation remained a purely practical astronomical problem. But a few decades later it gave rise to two classes of investigations of psychological importance, both of the experimental kind. The first was an investigation of a comparatively simple problem—the duration of the mental processes. Among such processes measured were the simple perception, the discrimination of several perceptions, the simple reaction to them, the reproduction of any suggested idea, the reproduction of a specific suggested idea, and so forth.

Not only was the duration of these processes studied, but also their dependence on differences of stimulation, the accompanying circumstances, the individual differences, the subject's trend of thought. The second class of investigations was concerned with the more complex mental processes of attending and willing. As examples may be mentioned inquiries into the attention of a person confronted by a multitude of impressions, a study of the order in which the several impressions are perceived, a determination of the largest number of impressions perceptible as a mental unit, and research into the causal relations between ideas and actions.

A more recent contribution of natural science to the advancement of psychology has come from investigations in the physiology and pathology of the central nervous system since the discovery about 1870 of the so-called speech center by Broca, and of the motor areas of the brain cortex by Fritsch and Hitzig. Some have placed a rather low value on this contribution and, noticing the errors and immature conceptions of this or that investigator, have arrived at the conclusion that psychology can learn nothing worth mentioning from the work of these men. This, it seems to me, is a great mistake.

Quite aside from innumerable details, psychology owes to the investigations made in recent years concerning the physiology of the brain two fundamental conceptions. In the first place it has come to be generally recognized that the search of centuries for the exact seat of the soul in the brain — for the point where mind and body come into interaction — is without an object. There is no seat of the soul in this sense; the brain is the embodiment of almost absolute decentralization. Our mind receives the impressions of the external world by means of widely sep-

arated parts of the brain, as different sensations, according to the peripheral organs stimulated. And our mind controls our actions by means of widely separated parts of the brain according to the local differences of the muscle groups which are called into action. All the parts of the brain are connected, but they function in relative independence, without being controlled from a single point. Now, it is clear that insight into this fact is of no little significance for our conception of the nature of mind.

In the second place it is only through the work of these neurologists that psychologists have come to realize how enormously complicated are even those mental functions which have always been regarded as comparatively simple. That the speech function, for example, involves consciousness of sound, of movement, and sometimes of sight, may be recognized immediately, and has been recognized. That our images of things are directly nothing but revived sense impressions of various kinds, visual, auditory, olfactory, and so on, and that our skill in handling things depends upon our experience obtained through running our fingers over them, is also recognized. But that all these images are more than abstractions, that they have a concrete significance even though the subject may not be aware of them, has been recognized only after the study of pathological cases, where, in consequence of peculiar lesions of the brain a dissociation has occurred among those factors which usually work together harmoniously, and where some of them are perhaps entirely lost. It was not until these pathological facts were known that psychology was able to give a definite formulation to certain of its problems. It then became clear that many former problems which took their origin from those popular simplifications, will, judgment, memory, or from the seeming simplicity of ideas

and movements, were perfect nonsense, considering the actual complexity of the facts. Now, after having learned how to formulate its problems, psychology can at last hope to understand the phenomena of mental life.

The study of the brain has also had an indirect influence upon psychology through the strong impulse which it gave to psychiatry. The knowledge gained in the study of the abnormal mind gave a new insight into the processes of the normal mind. And since psychiatrists most often came into contact with the highly complex mental states, such as emotion, intelligence, self-consciousness, the impulses which they gave to psychology were a happy supplement to those other influences which concerned chiefly sensation and perception.

During the last decades of the nineteenth century all these buds of a new psychology were — first by Wundt — grafted on the old stem and so united into an harmonious whole. They have rejuvenated the apparently dying tree and brought about a strong new growth. The psychology of the text-book and the lecture room has become a different science. The most conspicuous sign of this new conception of the science of the mind is the establishment of numerous laboratories exclusively devoted to psychological research.

In earlier times psychology was but the handmaid of other interests. Psychological research was not an end in itself, but a useful or necessary means to higher ends. Usually it was a branch or a servant of philosophy. Men took it up particularly in order to understand the foundations of knowledge, or how our conceptions of the natural world originated, and this again in order to draw metaphysical or ethical conclusions, to settle the controversy

between idealism and materialism, to answer the question as to the relation of body and mind, to derive rules for a rational conduct of life, often also with the mere purpose of confirming views springing from some other source. Others took up the study of psychology with a practical aim, for example, in order to find out how to make the most of their lives, or how to improve their memories. It is, to be sure, greatly to be hoped that psychology will not entirely lose its connection with philosophy, as natural science has unfortunately done. At no time, indeed, has the practical importance of psychology, its great usefulness in education, psychiatry, law, language, religion, art, been more strongly felt, or given rise to more numerous investigations than at present. But it is now recognized that, here as elsewhere, it is more fruitful for the true and lasting advancement of philosophical ends, instead of always thinking of advancing them, to forget them for the time, and to work on the preliminary problems as if these preliminary problems were the only ones existing. And so psychology, formerly a mere means to an end, has come to be regarded as a special science, to which a man can well afford to give his full time and energy.

A few data may illustrate what we have just said. Until the last decades of the nineteenth century psychology has not been able to support a journal of its own. A few attempts in this direction were made in the eighteenth century, when two psychological periodicals were started; but neither published more than a few volumes. Even in the middle of the last century magazine articles of psychological content were rare enough and appeared only in philosophical, physiological, or physical journals. During the last thirty years a complete revolution has taken place in this respect, more remarkable than in any other branch

of science. First at longer intervals, then in quick succession, numerous purely psychological journals were founded in the principal civilized countries, of which none thus far has been compelled to retire on account of lack of either contributors or readers. We count at present at least fifteen, six of them in German, four in English, three in French, one in the Italian language, and one representing the Scandinavian peoples. And there is an equal number of periodical publications of single investigators and institutions, and also numerous writings of psychological importance published in philosophical, physiological, psychiatric, pedagogical, criminological, and other journals.

### QUESTIONS

1. How old is the science of psychology ?
2. What do you know about its early growth ?
3. What are the difficulties besetting psychology ?
4. What is the origin of popular psychology ?
5. Why is psychology so much hampered by prejudice ?
6. State the two ways in which psychology has been influenced by natural science.
7. How was psychology influenced by medieval theology ?
8. Who were the opponents of theological psychology ?
9. What does freedom of action mean ?
10. What kind of ignorance is the cause of the belief in absolute freedom ?
11. How did the associational psychology originate ?
12. What is meant by the faculty psychology ?
13. What does psychology owe to Herbart ?
14. What is voluntarism ?
15. Why are mechanical explanations of mental life inadequate ?
16. From which science can psychology obtain the most fruitful analogies ?
17. Which science gave in the earlier part of the nineteenth century the strongest direct impulse to psychology ?

18. What is psychophysics and who is its author ?
19. What is meant by the personal equation ?
20. What experimental investigations were suggested by the personal equation ?
21. How did the study of the physiology of the brain influence psychology ?
22. Is psychology a special science ?



## CHAPTER I

### GENERAL PSYCHOLOGY

#### § I. BRAIN AND MIND

As we all know, the processes of our mental life stand in the closest relationship with the functions of the nervous system, especially with the functions of its highest organ, the brain. Local anemia, that is, a lack of blood in the brain, causes fainting, a cessation of consciousness ; on the other hand, during mental work the blood pressure in the brain is higher than usual and metabolism is increased. Narcotic or poisonous drugs, as alcohol, caffeine, and morphine, which influence mental activity, do this by means of their effect on the nervous system. Aside from such experiences, there are two special groups of facts upon which our knowledge of this relationship is based.

First the dependence of mental development on the development of the nervous system. This is most conspicuous when man and animals are compared. It is somewhat obscured, however, by the relation of the size of the brain to the size of the animal. The larger animal has as a rule the larger brain. Therefore the brain of man can be compared only with the brain of such animals as are of nearly the same size. When such a comparison is made, man is found to be no less superior in nervous organization than in intelligence. His brain is about three times as heavy, absolutely and relatively, as that of the animals most nearly approaching him, the anthropoid apes ; eight to ten times as heavy as

the brain of the most intelligent animals lower down in the scale, for instance large dogs. Similar relations between brain weight and intelligence are found in the human race itself. Of course, we cannot expect that this relation will always be found in a comparison of only two individuals. The conditions are too complex for such a regularity to exist; but it is easily demonstrated when averages of groups of intelligent and unintelligent men are compared. We do not expect, either, that in every individual case physical strength is exactly proportional to the weight of the muscles, although no one doubts that strength depends on the weight of the muscles.

The second of the facts upon which our knowledge of the relationship between mental life and nervous function is based, consists in the parallel effects of disturbances of their normal condition. Diseases or injuries of the brain are, as a rule, accompanied by disturbances of the mental life. On the other hand, mental disturbances can often be traced to lesions or structural modifications in the brain. This cannot be done in every case; but the actual connection is none the less certain. It is often very difficult to decide whether or not any mental abnormality exists. Expert psychiatrists have for weeks at a time observed men suspected of mental disease without being able to pronounce judgment. Equally difficult is the discovery of material changes in the brain and its elements. Much progress has been made in recent times in this respect; but it is still far from easy to recognize the more delicate changes in nervous structure resulting from disease. Certain abnormalities may never become directly visible although they involve disturbances of function, for instance, abnormalities in the nutrition of the nervous elements or changes in their normal sensitivity. No wonder, then,

that for many mental diseases, as hysteria, corresponding material lesions are not yet known. But the correctness of our thesis is so strongly secured by the enormous number of cases in which it has been demonstrated, that no one doubts that it applies also to those cases in which, often for good reasons, its demonstration has thus far been impossible.

Of much importance is the particular form of this relationship between brain function and mental life. Popular thought attributes the chief classes of total mental activity to special parts of the brain. Judgment is thought to have its seat behind the thinker's high forehead. The occipital part of the brain is, according to the medieval philosophers, the organ of memory. And so Gall's phrenology met with ready acceptance from the public at large, which was delighted to learn that musical ability, mathematical talent, religious sentiment, egotism and altruism, and many other character traits had their special organs in the brain. But anatomists and physiologists have not been able to admit the plausibility of this doctrine.

Yet popular thought has, on the other hand, always emphasized the unity of mind. Those who regard its unity as the chief characteristic of mind have for centuries sought for the single point in the brain where the mind can be said to have its seat. If it were distributed all through the brain, would it not be possible to cut the mind into pieces by simply cutting the brain?

That both these views of the relation between brain and mind are inadmissible has become certain. Since about forty years ago the truth in this matter has been known. But to understand it clearly it is necessary first to familiarize ourselves with the construction of the nervous system.

## QUESTIONS

23. What do we learn from a comparison of brain weight and intelligence?
24. What is the relation between nervous pathology and mental abnormality?
25. Is phrenology admissible?
26. What view concerning the relation of brain and mind is suggested by the unity of mind?

## § 2. THE NERVOUS SYSTEM

1. *The Elements of the Nervous System*

The number of elements making up the nervous system is estimated at about four thousand millions. It will help

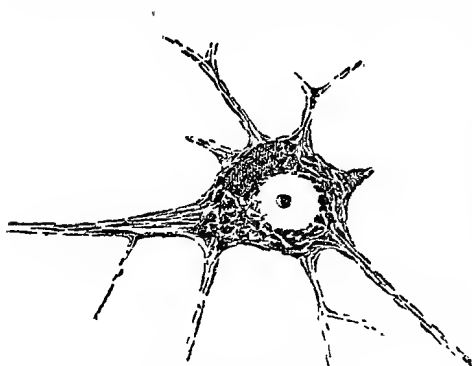


FIG. 1. — MULTIPOLAR CELL BODY.

us to comprehend the significance of this number if we understand that a man's life devoted to nothing but counting them would be too short to accomplish this task, for a hundred years contain little more than three thousand

million seconds. These elements are stringlike bodies, so thin that they are invisible to the naked eye. They are generally called *neurons*. Within them different parts are to be distinguished. The part which is most important for the neuron's life is a spherical, bobbin-shaped, pyramidal, or starlike body, called the ganglion

cell or cell body, located usually near one of the ends of the long fiber of the neuron, but sometimes nearer the middle of the fiber. The length of the fiber varies from a fraction of an inch to several feet. The fiber may be compared with a telephone wire, inasmuch as its function consists in carrying a peculiar kind of excitatory process.

At both ends of the neuron are usually found treelike branches. When the cell body is located near one of the ends of the fiber, many of these branches take their origin from the cell body and give it the pyramidal or starlike appearance

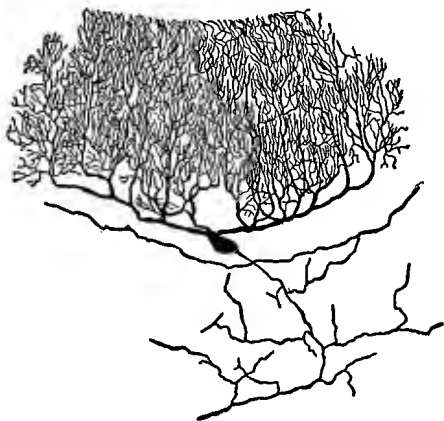


FIG. 3.—DENDRITES OF A NERVE CELL OF THE CEREBELLUM.

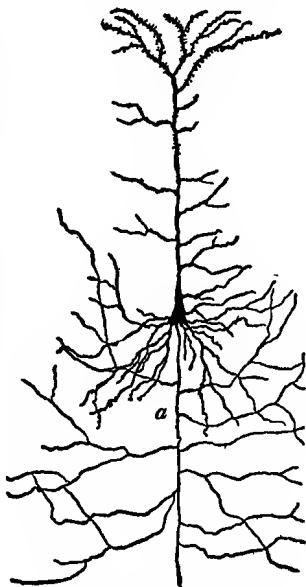


FIG. 2.—PYRAMIDAL CELL BODY.

*a*, Nerve fiber with collaterals.

illustrated by figures 1, 2, and 4. These branches are called dendrites, from the Greek word for tree, *dendron*. How wonderfully complicated the branching of a neuron may be is

illustrated by figure 3. In addition to the dendrites a neuron possesses another kind of branches, resembling in

character the tributaries of a large river, entering into it at any point of its course. These are called collaterals (lowest part of figure 2).

The ganglion cells have a varying internal structure, which may be made visible to the eye when the cells have

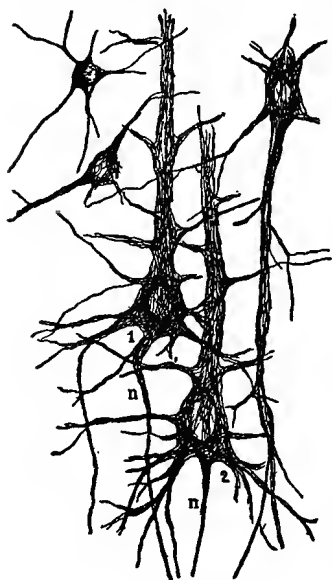


FIG. 4.—VARIOUS TYPES OF CELL BODIES.

1 and 2, Giant pyramidal cell bodies;  
n, nerve fiber.

been stained by the use of different chemicals. They are found to contain small corpuscles with a network of minute fibrils between them, as shown in figures 1 and 4. The nerve fibers, too, in spite of being only  $\frac{1}{40}$  to  $\frac{1}{500}$  mm. thick, permit us to distinguish smaller parts (fig. 5). The core consists of a bundle of delicate, semi-fluid, parallel fibrils, the axis-cylinder. This is surrounded generally by a fatty, marrow-like sheath, and

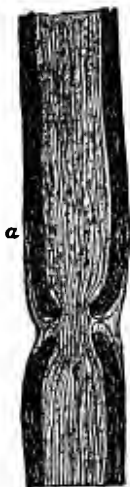


FIG. 5.—LONGITUDINAL SECTION OF A NERVE FIBER WITH STAINED FIBRILS.

a, Medullated sheath.

in the peripheral parts of the system this sheath is again inclosed in a membrane. Certain fibers attain a considerable length, for example, those which end in the fingers and toes, having their origin in the spinal region of the body.

The treelike branches of the main fiber and of the collaterals, if far away from the cell body, are sometimes called the terminal arborization, from the Latin word for tree, *arbor* (fig. 6). The treelike branching has most probably a functional significance of great importance. It enables the endings of different neurons to come into close enough contact to make it possible for the nervous processes to pass over from one neuron into another neuron, without destroying the individuality, the relative independence of each neuron.



FIG. 6.—TERMINAL ARBORIZATION OF OPTICAL NERVE FIBERS.

Wherever large masses of neurons are accumulated, the location of the ganglion cells can be found directly by the naked eye. The fibers are colorless and somewhat transparent. Where they are massed together, the whole looks whitish, as is the case with snow crystals, or foam. The ganglion cells, however, contain a dark pigment, and where many of them are present among the fibers, the whole mass looks reddish gray. Accordingly one speaks of white matter and gray matter in the nervous system.

The nature of the excitatory process for the carriage of which the neurons exist is still unknown. It is certain, however, that this process is not an electrical phenomenon. Electrical changes accompany the nervous process and enable us to recognize its presence and even to measure it; but they are not identical with the nervous process.

Probably it is a kind of chemical process, perhaps analogous to the migration of ions in the electrolyte of a galvanic element, the lost energy being restored by the organism. Two facts are especially noteworthy. The velocity of propagation has been found to be about 60 meters per second in the human nervous system. In the lowest animals propagation is often considerably slower. It is clear, therefore, that it is an altogether different magnitude from the velocities found in light, electricity, or even sound.

A second fact is the summation of weak stimulations. The second one produces a stronger effect than the first, the third again a stronger effect, and so on. It also happens that a number of successive stimuli produce a noticeable effect, whereas one of these stimuli alone, on account of its weakness, would produce none. On the other hand, if strong stimuli succeed one another, the effect becomes less and less conspicuous. The neurons are fatigued, as we say, and require time for recuperation.

## 2. *The Architecture of the Nervous System*

The elements of the nervous system just described are combined into one structure according to a surprisingly simple plan, in spite of its seeming complexity. This apparent complexity results chiefly from the enormous number of elements entering into the combination. The purpose of the nervous architecture may be briefly described thus: The conductivity of the nervous tissue is employed to *bring all the sensory points of the living organism into close connection with all the motor points, thus making a body capable of unitary action out of a mere accumulation of organs, each of which serves its specific end.* Walking along and meeting an obstacle, I must be able first to look



about and find a way of pushing it aside or climbing over it, and then to push or climb. This is impossible unless my eyes are connected with the muscles of the head, the arms, the legs. Perhaps I am inattentive, or it is dark, so that I run against the obstacle with my feet or my body. In this case it is necessary that the sensory points of my skin be connected with all those muscles. Hearing a call, I must be able to turn my head so that I may hear more distinctly the sound I am expected to perceive; but I must also be able to move my tongue and the rest of my vocal organs in order to answer, or, as the case may require, my arms and legs in order to defend and protect myself. Thus the ear and all other sensory points of the body must be closely connected with all the motor points.

It is plain, then, that the simplest kind of nervous system must consist of three kinds of neurons: sensory (often called afferent), motor (often called efferent), and connecting neurons. To improve the working of such a system, the afferent and the efferent neurons, and especially the connecting (associating) paths, are developed by the introduction of additional neurons, serving to cross-connect the primary chains of neurons. Figure 7 illustrates the architecture of an exceedingly simple nervous system of the most rudimentary kind.

A perfection of the system is brought about by a superstructure built on essentially the same plan. Figure 8 is a diagram illustrating this. The points  $S'$  and  $M'$  correspond to the points of the same names in figure 7. But several systems (three in the diagram) like that of figure 7 have been combined by connecting neurons in exactly the same manner in which the combination was effected in figure 7. In this higher system (nerve center, we should

call it) the points  $S''$  and  $M''$  have a significance comparable to that of  $S'$  and  $M'$ .

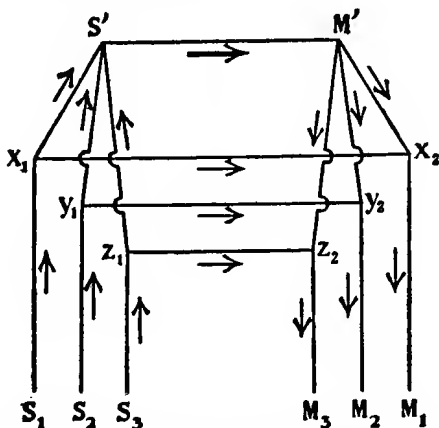


FIG. 7. — DIAGRAM OF NERVOUS ARCHITECTURE: REFLEX ARCHES CONNECTED BY A LOW NERVE CENTER.

(From *Psychological Review*, 15, 1908.)

Several of these larger systems (three in the diagram) are combined again by means of connecting neurons in

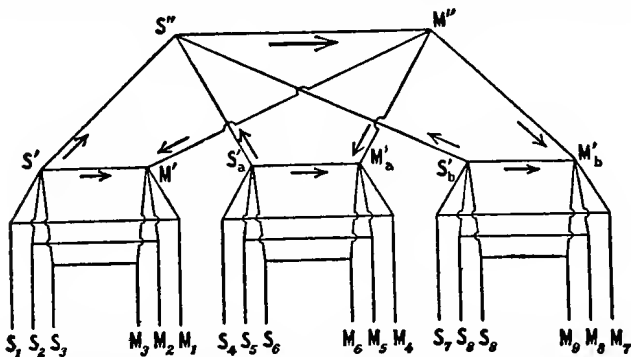


FIG. 8. — DIAGRAM OF NERVOUS ARCHITECTURE: LOWER NERVE CENTERS CONNECTED BY A HIGHER CENTER.

(From *Psychological Review*, 15, 1908.)

exactly the same manner as before. This is illustrated by figure 9. The points  $S'''$  and  $M'''$  have a significance like that of  $S'$  and  $M'$ ,  $S'''$  being nearer to sensory points of the body than to motor points,  $M'''$  being nearer to motor points. This system of connecting neurons represents again what we may call a higher nerve center—higher still than those which are combined in it.

Thus we may conceive any number of systems, one still higher than the other. And we may understand how it is

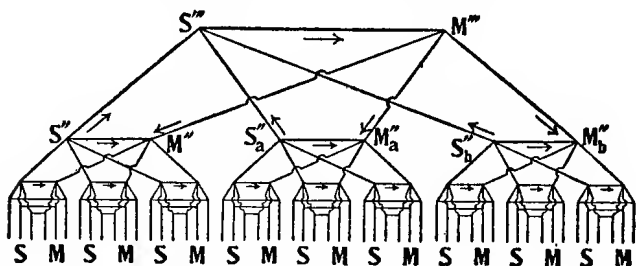


FIG. 9.—DIAGRAM OF NERVOUS ARCHITECTURE: HIGHER NERVE CENTERS CONNECTED BY A STILL HIGHER CENTER.

possible that simpler mental functions may enter into a combination, forming a unitary new function, without completely losing their individuality as functions of a lower order; for combinations of simple functions represented by *direct* connections into complex functions are brought about only by mediation of higher connecting neurons which represent the *less direct* connections of sensory and motor points. The most manifold associations are made possible. A practically inexhaustible number of different adaptations is structurally prepared, so that the most complicated circumstances and situations find the organism capable of meeting them in a useful reaction. This type of nervous system is the property of the highest animals and

of man. The lower type of nervous system is represented by the reflex arches of the so-called spinal and subcortical centers. The higher type is represented by the cerebrum and cerebellum, which during a process of evolution covering hundreds of thousands of years have gradually been developed to serve as the highest centers of the nervous system.

### 3. *The Anatomy of the Nervous System*

The most prominent part of the nervous system is that inclosed within the skull and the vertebral column. The spinal cord runs all through this column up to the skull. Entering into the skull, it thickens and forms what is called the bulb (medulla oblongata). It then divides into several bodies, which are referred to as the subcortical centers, because they are located below the cortex, which is the surface layer of the cerebrum, or large brain. These subcortical centers contain the central ends of neurons which are links of chains of afferent neurons coming from the higher sense organs and from the sensory points of the skin and the internal organs. Chains of efferent neurons, on the other hand, take their origin in the subcortical centers, reaching at their peripheral ends the motor points of the body, that is, the muscle fibers of our skeletal muscles and of the muscle tissues contained in the alimentary canal and the other internal organs.

Above and partly surrounding the subcortical centers are the large brain and the cerebellum or small brain. The ganglion cells of the neurons contained in the cerebrum and cerebellum are all located near the surface or cortex. There seems to be a peculiar advantage — not yet perfectly understood — in having the gray matter spread out over the surface of the cerebrum and cerebellum in as thin a layer as possible. To this end the surface of the cerebrum is much increased by the formation of large folds, separated

by deep fissures (see figure 10). In the cerebellum the folds are more numerous and exceedingly fine, and they do not have the appearance of being the product of fissuration. The surface of the cerebrum is estimated to be equal to a square with a side eighteen inches long. Without the fissures the surface would be only about one third of this. The mixture of ganglion cells and fibers making up the

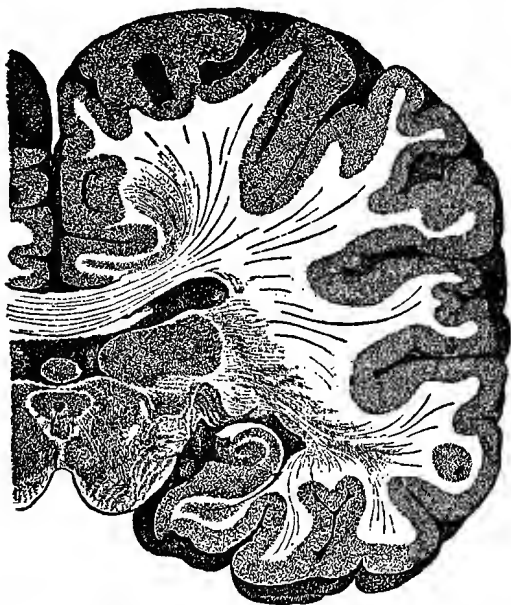


FIG. 10.—FRONTAL SECTION OF THE RIGHT CEREBRAL HEMISPHERE.

gray matter of the brain is illustrated in figures 11 and 12. Both are sections of the cortex of the cerebrum. In figure 11 the cell bodies alone are stained and thus made visible; in figure 12 the fibers alone are stained.

From what has been said thus far it is clear that certain areas of the cortex must be connected with certain groups

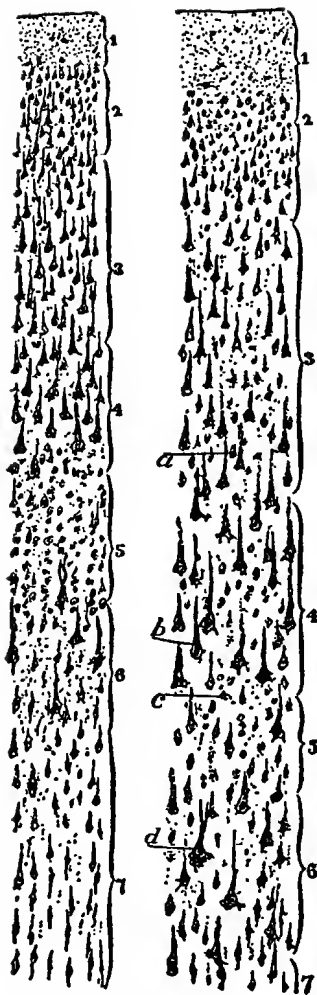


FIG. 11.—SECTION OF THE CERE-  
BRAL CORTEX.

Only the cell bodies are stained.



FIG. 12.—SECTION OF THE CERE-  
BRAL CORTEX.

Only the fibers are stained.

of sensory points or motor points of the body much more directly than with others. This is confirmed by histological, pathological, and experimental investigations. For the eyes and the ears, for the muscles of arms and legs, hands and feet, even the several fingers and toes, the correspond-

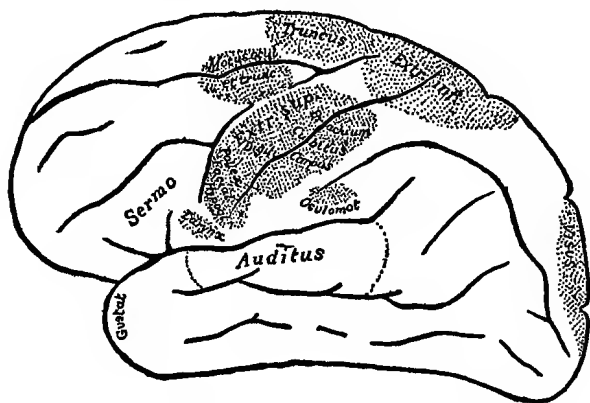


FIG. 13.—LOCALIZATION OF PERIPHERAL FUNCTIONS IN THE CEREBRAL CORTEX.

ing areas of the cortex—that is, the areas with which there is direct connection—are definitely known. Figure 13 conveys an idea of the relation between certain parts of the brain and the sensory and motor organs of the body.

#### 4. *The Nervous System and Consciousness*

We have already touched on the question as to the relation between the nervous system and consciousness. It is evident that no single point of the nervous system can be regarded as the long-searched-for seat of the soul, since no single point is structurally or functionally distinguished from all others. But it does not follow that mental func-

tions are localized in different parts of the brain according to the popular conception of judgment, memory, will, and so on, each depending on a special part of the brain. There is no more truth in the similar assertions of phrenology. Localization of function in this sense is impossible. Judgment is not a mental function which can be separated from memory and attention. No more separable from each other are such functions as religious sentiment, filial love, self-consciousness. The sensational, ideational, and affective elements of these functions are to a considerable extent the same.

Localization of mental functions really means this:— Since there is a division of labor among the sensory and motor organs of the body, and since each of these organs is most directly connected with certain areas of the cortex and much less directly with the other areas, it is to be expected that certain states of consciousness will occur only when certain areas of the cortex are functioning. It is but natural that the province of the cortex most directly connected with the eyes serves vision, including both visual perception and visual imagination; that the province of the cortex most directly connected with the ears serves audition. Who would expect anything else? In the same sense, the sensations of touch, of taste, and so on, are localized in the brain. The same rule holds good for movements. When our limbs move in consequence of some thought concerning them, the areas of the cortex which are most closely connected with them must function, while other areas may remain inactive. Activity of our vocal organs, in the service of our mind, can occur only by the influence of that province of the cortex which is most directly connected with the muscles of the vocal organs. But how varied are the thoughts which may bring about action of the vocal organs! On the other hand,



how diversified may be the movements by which a mother may react upon the crying of her child! In either case it may be right to say that our mind is localized in the brain as a whole—not, of course, equally in every infinitesimal particle, but distributed through the brain in a manner comparable to the distribution of the roots and branches of a tree.

### QUESTIONS

27. To what kind of things are the neurons comparable?
28. How many neurons does the nervous system contain?
29. What kinds of branches does a neuron possess?
30. What are white matter and gray matter?
31. How does the velocity of a nervous process compare with other velocities in nature?
32. What is the general function of the nervous system?
33. Can you draw a diagram illustrating the architecture of a simple and of a more complex nervous system?
34. How can simpler nervous functions enter into a combination without completely losing their individuality?
35. What is meant by subcortical?
36. What is meant by afferent and efferent neurons?
37. How large is the surface of the brain?
38. What is meant by sensory and motor areas of the cortex?
39. Where is the seat of the soul?

### § 3. EXPLANATION OF THE FUNCTIONAL RELATION BETWEEN BRAIN AND MIND

How the functional relation between the mind and the nervous system should be explained, is a question discussed for centuries and variously answered. But all the answers are essentially either the one or the other of these two: (1) Either the brain is a tool of the mind, or (2) it is an objectified conception of the mind itself.

### I. *The Brain a Tool of the Mind*

Popular thought, supported by desires common to all human beings, readily accepts the view that mind is essentially different from matter, that its laws are in every respect different from the laws of material nature, and that the brain, being a part of the material nature, is simply the special tool used by the mind in its intercourse with nature. Consider what a contrast seems to exist between logical certainty and the mere probability derived from more or less deceptive sense impressions, between voluntary attention and sensual desire, between religious inspiration and ordinary perception, artistic creation and everyday work. Nevertheless, these highest as well as the lowest activities of the mind need a tool with which they can get into communication with the world; and this tool, says popular thought, is the brain. By means of this tool the mind can take possession of the world and shape it at will. This explanation of the functional relation between the mind and the nervous system agrees well with the facts above discussed concerning brain weight and intelligence, and nervous pathology and mental abnormality. That the magnitude, the architecture, the normal condition of a tool have an influence on the task performed, is plain enough. Many a piece of music can be played on a large organ having a great variety of stops, whereas its performance on a small instrument would be impossible. Raffael might have deserved the name of a great painter if born without arms, but the world would never have known it.

The facts of localization of function, however, do not agree so well with this tool conception of the brain, which always leads us back again to the theory that the mind takes hold of its tool at a single point. If the mind can

suffer or produce *this* change only here, *that* change only there, it is difficult to see why we should regard it as an altogether separate entity. Some have pointed out, as an analogy, that truth too is everywhere, and because of its absolute unity, everywhere in its totality, without being bound to space and time. I must doubt, however, if truth is present where such analogies are worked out, for nothing can be less clear than the assertion that truth has unity. Mind is not everywhere in its totality, neither in the brain nor in the whole world. It is partly here, partly there; as seeing mind it is in the occipital convolutions of the brain, as hearing mind in the temporal convolutions. Thus we are forced, if we regard the brain as the mind's tool, to regard the mind as an entity possessing spatial form. If we reject this conclusion, we must also reject the premise that the brain is the mind's tool.

There are two other difficulties of very considerable importance. One of them is compliance with the principle of the conservation of energy. If mind is an entity independent of the brain, if the brain is a tool which mind can use arbitrarily, without having to obey the laws of the material world, there would be a serious break in the continuity of natural law, and the principle of the conservation of energy would suffer an exception.

Until recently it was, not probable, but at least possible, that this principle of the conservation of energy was not strictly correct when applied to conscious beings, especially to man. But in recent years direct experiment has proved that it applies to the dog, and even to man. In an animal performing no gross muscular work the energy supplied by the food is completely transformed into heat, which is absorbed by the animal's surroundings. Rubner has found as the result of very exact measure-

ments that the heat produced by an animal during several weeks is within one half of one per cent (that is, within the probable error) equal to the quantity of chemical energy received from the food. One might think that it would be rash to apply conclusions reached by experimenting on a dog to man, whose mental life stands on a much higher level. But even this objection has been removed by Atwater. He performed similar experiments on five educated persons, varying the conditions of mental and muscular activity or relative rest. The result is the same. Taking the total result, there is absolute equality between the energy supplied and the energy given out; in the human organism, mind has thus been proved to be subject to the laws of the natural world.

The second difficulty spoken of consists in the fact that, accepting the view which regards the brain as the mind's tool, we cannot well avoid regarding the mind as a kind of ghost or demon, similar to the demons with which the imagination of primitive peoples populates the universe—gaseous and usually invisible men, women, giants, or dwarfs. Mankind has always felt strongly inclined to believe in the existence of such demons, and is still fond of making them the subjects of fairy tales and similar stories. But the more mature experience of the last centuries of human history has eliminated them from our theories of the actual world and assigned them their proper places in tales and mythology. Winter and summer, rain and sunshine, even the organic processes in the heart or the spinal cord are understood only by excluding from the explanation the assumption of such demons. The same is by analogy true for the processes in the brain, for the brain is not likely to be an exception to the rule. It is more difficult, of course, to determine directly whether such a demon exerts his in-

fluence in the inaccessible cavity of the skull than it is on the street or even in a haunted house. But no assertion is entitled to be regarded as true merely because we cannot go to the place in question and observe that it is false. Why not assert that heaven is located on the back side of the moon and hell in the center of the sun, merely because no one can see with his own eyes that they are not there? We must make only those assumptions which, considered from all points of view, have a high degree of probability, not those which flatter our vanity or appeal to us as the fashionable belief of the time. Now, it does not seem probable that our brain is the residence of a separable demon, no matter whether we attribute to him the power of changing at will the total amount of energy contained in our body, or conceive his activity, as some psychologists do, as a new form of energy added to the mechanical, thermal, electric, chemical, and so on, — requiring only an additional transformation of energy and not breaking down the principle of its conservation.

## 2. *The Brain an Objectified Conception of the Mind*

If we cannot regard the brain and the mind as two independent entities, scarcely any other conception of them is possible except as a single entity of which we may obtain knowledge in two ways, an objective and a subjective way. *Mind* knows itself directly, without mediation of any kind, as a complex of sense impressions, thoughts, feelings, wishes, ideals, and endeavors, non-spatial, incessantly changing, yet to some extent also permanent. But *mind* may also be known by other minds through all kinds of mediations, visual, tactual, and other sense organs, microscopes and other instruments. When thus known by other minds, mind appears as something spatial, soft, made up of

convolutions, wonderfully built out of millions of elements, that is, as brain, as nervous system. By mind and brain we mean the same entity, viewed now in the aspect in which mind knows itself, now in the aspect in which it is known by other minds.

Suppose a person is asked a question and after some hesitation replies. In so far as this act is seen, heard, and otherwise perceived (or imagined as seen, heard, or otherwise perceived), it is a chain of physical, chemical, neurological, etc., processes, of material processes as we may say. But that part of the chain of material processes which occurs in the nervous system may not only be known by others, but may know itself directly, as a transformation of perceptual consciousness into thought, feeling, willing. The links of these two chains of material processes in the brain and of mental states should not be conceived as intermixed and thus forming one new chain, but rather as running parallel — still better as being link for link identical. The illusion that one of these chains brings forth the other is caused by the fortuitous circumstance that they do not both become conscious at once. He who thinks and feels cannot at the same time experience through his sense organs the nervous processes as which these thoughts and feelings are objectively perceptible. He who observes nervous processes cannot at the same time have the thoughts and feelings as which these processes know themselves. Those objective processes, however, which go on outside of the nervous system, in particular those outside of the experiencing organism, in the external world, precede or follow mental states as causes generally precede their effects and effects follow their causes. There is no objection to speaking of a causal relation between material processes of this kind and mental states.

Whatever explanation of the functional relation between brain and mind a person may accept, he need not constantly be on his guard lest he be inconsistent. We speak of the rising and setting sun without meaning that the earth is the center of the universe and that the sun moves around it. So we may also continue to speak quite generally of the material world as influencing our mind, and of the mind as bringing about changes in the material world.

Our view of the relation between body and mind leads to the further conclusion that, as our body may be distinguished from its parts without having existence separate from its parts, so our mind may be distinguished from the several states of consciousness without having existence separate from them. Mind is the concept of the totality of mental functions. As self-preservation is the chief end of all bodily function, so self-preservation is the chief end of mental life.

### QUESTIONS

40. Do the facts of comparative anatomy and of localized function agree with the view that the brain is the mind's tool?
41. Is mind subject to the law of the conservation of energy?
42. Is mind a demon interfering with the laws of nature?
43. What is the cause of the illusion that nervous processes bring forth mental states, or that mental states bring forth nervous processes?
44. Why is it correct to regard certain events going on outside of the organism—and even in the organism, but outside of the nervous system—as effects or as causes of certain mental states?
45. Is there any objection to distinguishing our mind from the several mental states?

## CHAPTER II

### THE SPECIAL FACTS OF CONSCIOUSNESS

#### A. THE ELEMENTS OF MENTAL LIFE

##### § 4. SENSATION

##### 1. *The Newly Discovered Kinds of Sensations*

WE shall discuss first the simplest facts of mental life, later their complications. It has often been objected that such a treatment is not in harmony with the fact that we are more familiar with the complications than with the simpler facts. But we are also more familiar with our body than we are with muscle cells, nerve cells, and blood corpuscles, and yet we do not object to beginning the study of biology by a study of the structural elements and their chief properties. No one understands this to mean that the cells of various kinds existed first separately and were then combined into the body which consists of them. No one should believe that the simple mental states existed separately and were then combined into those complications with which we have become familiar in everyday life. Simple mental states are abstractions. But we cannot hope to understand the complexity of mental life without using abstractions.

Through the sense organs our mind receives information about the external world. The traditional classification of the sensations divided them into five groups. But the dis-



tion of five senses has been found to be insufficient. At least twice as many must be distinguished.

When psychologists tried to explain all human knowledge in terms of experience, they met with some difficulty in the description of our experience of solid bodies. Tactual sensation was found to be insufficient for this explanation, since it informs us only of the side-by-side position of things, that is, of only two dimensions. It was soon recognized that the movements of our limbs were important factors in this experience, and the question was asked: How do we perceive the spatial relations of our limbs and the resistances offered to changes in these spatial relations, that is, to movements? The first answer to this question was, that the muscles, being obviously a kind of sense organ which gives us the familiar sensations of fatigue and muscular pain, are also capable of sending in definite groups of afferent nervous processes according to their conditions of contraction and tension. This answer was quite true, as far as it went; and about 1870 the sensory neurons of muscles were actually discovered. The tendons connecting the muscles with the bones were also found to contain sensory neurons.

But this cannot be all, for we are able to judge the position of our limbs even when the muscles are completely relaxed and a limb is moved by another person. It is further a fact that a weight and the distance through which it is moved can be estimated with fair accuracy, whether the arm is sharply bent or straightened out, although the contraction and tension of the muscles is very different in these two cases. It is now known with some certainty how these estimations are made possible. The surfaces of the joints are furnished with nerves. Make a slow movement of the hand or a finger and attend to the

sensation resulting from it. There is little doubt that the sensation is localized in the joint. This view is supported by the fact that electrical stimulation of a joint considerably decreases the accuracy of the estimation of weight and movement.

The three classes of sensations—muscular, tendinous, and articular—are customarily grouped together under one heading as *kinesthetic* sensations, meaning literally sensations of movement. But, as we have noted, these sensations occur as the result not only of movements of our limbs, but also of pressure or pull when the limb is at rest. They always occur together with tactual sensations, but must nevertheless be strictly distinguished from them.

Soon after this distinction had been recognized, the tactual, or rather cutaneous, sense was found to consist of several senses. The impressions of touch, that is, of pressure on the skin, of temperature, and of pain had always been distinguished; but it had not been known that the areas of greatest sensitivity for touch are not identical with those for temperature, and that the sensitivity for pain may be greatly diminished without a corresponding change in the sensitivity for touch. It was only about 1880 that these observations were explained, when an anatomical separation of the neurons serving these different sensations was demonstrated. If we test the sensitivity of the skin by carefully stimulating single points, it is found that not every point of the skin is sensitive, but that the sensitive points are isolated by larger or smaller insensitive areas. It is further found that the points sensitive to warmth are different from those sensitive to cold or to pressure or to pain. This can easily be demonstrated for the cold points by touching the skin in a number of successive points with a steel pen or a lead pencil. Generally only the touch is

perceived, but now and then an intense sensation of cold is felt on definite points, always recurring when these points are touched. It is somewhat more difficult to demonstrate the points sensitive to warmth. The sensation is in this case much less noticeable. The points sensitive to touch are on hairy parts of the skin always close to a hair; on other parts, for instance the palm of the hand and particularly the finger tips, they are located so close together that their separateness can be proved only by the use of very delicate instruments. The same is to be said of the pain points of the skin. We cannot, therefore, regard the skin as one organ of sense, but must regard it as containing four classes of organs serving the senses of warmth, cold, pressure, and pain.

We must be sure, of course, to distinguish between pain, as a sensation, and the feeling of unpleasantness which almost without exception accompanies pain. We must further distinguish the sensation of pain from intense cold, intense heat, strong pressure, dazzling light, all of which may produce pain as a secondary effect. But the sensation of pain is quite dissimilar from the sensations of cold, heat, pressure, and light, to which it is added in consequence of physiological conditions. The independence of the sensation of pain can easily be demonstrated by touching the cornea of the eye with a hair. Pain is then perceived without any touch or temperature sensation. The pricking sensation in our nose resulting from the breathing of chlorine or ammonia may also be mentioned as an illustration of the same point. Let us further understand that pain is not only a cutaneous sensation, but also a sensation localized in internal organs; for instance, headache, toothache, colic.

The most interesting discovery of a new sense organ

concerns the labyrinth of the ear. It was made quite unexpectedly. The labyrinth consists of the inner ear proper, or the cochlea, the system of three semicircular canals, and between these two organs a pair of small sacs, each containing a little stone or otolith, built of microscopic lime crystals. All these organs, being all of the nature of cavities filled with fluid and communicating, were originally regarded as serving the sense of hearing, although no one was able to say how. It was observed, however, that stimulation or lesion of the semicircular canals and of the sacs did not affect hearing, but resulted in disturbances of the coördination of the muscular activities in locomotion and normal position. For more than fifty years these observations remained unexplained; and even then their explanation was but slowly accepted.

It is now recognized that the semicircular canals and the sacs are not organs of hearing, but organs informing the organism about the movements or position of the head, and indirectly of the body as a whole. The sensations coming from these organs are usually so closely bound up with kinesthetic and tactual sensations that we have not learned to become conscious of them as a separate kind. Nevertheless we may perceive them separately under favorable circumstances. If we close our eyes, turn quickly a few times on our heel, and suddenly stop, we are vividly conscious of being turned in the opposite direction. This is a perception mediated by the semicircular canals. The fluid ring in the horizontal canal gradually assumes the motion of the body, in consequence of its friction against the walls; and when the body suddenly stops moving, the fluid ring continues to move and to stimulate the sensory neurons for some time. If the body moves in a larger circle, for example on a merry-go-round or on a street car passing

around a curve, the mind perceives an inclination of the body towards the convex side of the curve. If we go up in an elevator, we have the impression, just after the elevator has stopped, of moving a short distance down. These are sensations of the otolith organs.

The otoliths are slightly movable, one in the horizontal, the other in the vertical direction. If the body moves through a curve, the otolith which by centrifugal force is driven outwards stimulates the sensory neurons in the same manner in which it stimulates them when the body is inclined. The perception of the body's position is therefore the same. If the body is quickly moved up or down, the vertical otolith at first lags behind, and at the stop, through its inertia, continues to move a little in the same direction. The result is a brief perception of the body moving in the opposite direction.

Artificial stimulation or lesion of the semicircular canals or otolith organs in animals tends to produce certain unexpected reflex movements of the body which the animal tries to counteract voluntarily, so that all kinds of unusual movements are observed. If these organs are destroyed, one source of information about the position and the movements of the body is lost. This loss is not very serious in man, in whom it occurs as a result of diseases of the ear; man can obtain his orientation from visual, kinesthetic, and pressure sensations in spite of this loss. It is far more serious in aquatic and flying animals. Pressure differences are of no account when the body has nothing but water or air on all sides. In a greater depth of water vision is practically impossible. Under these circumstances the semicircular canals and the otolith organs are highly important for an animal's life. Unfortunately no definite names have thus far been adopted for these senses. They

are frequently called the static sense or the sense of equilibrium. But these names are of doubtful value, since other senses too may inform us about our equilibrium.

The enumeration of our senses is not yet completed. What is hunger? What is thirst? What is nausea? These mental states are certainly similar, in some respects, to tones and odors. They are sensations. There is the difference, however, that we do not project them into external space, but think of them as characteristics of our own body's condition. How is consciousness of these sensations brought about? No doubt, in a manner similar to that of the mediation of such sensations as odors and tones: through the stimulation of sensory neurons and the propagation of nervous processes toward the motor points of the body. The place of stimulation must be somewhere in our organs of nutrition, and thus these organs must be regarded also as a kind of sense organ. That the sensory function can be attributed to an organ in addition to another function has been proved by the example of the skin, muscles, and joints. The same may be said of other organs, for instance the lungs giving us the sensation of suffocation.

We possess, therefore, a large number of organs whose primary function is of an active kind, but which also give information as to the condition of those active functions. The sensations resulting from them are as independent of each other as tones are of color or taste. But they do not permit of as many subdivisions as the sensations of the so-called higher senses. For the emotional part of our mental life they are of the greatest significance. Since we do not project them into the external world, but think of them as significant of the functions of our internal organs, they are rightly called by the common name of *organic sensations*.

## 2. *The Other Sensations*

Besides the cutaneous sensations four classes were known to the older psychology: sensations of color, sound, odor, and taste. The relation of these sensations to the corresponding stimuli comprises a vast number of problems and theories, but we shall here state merely that which is of more general interest.

The taste — in the ordinary sense — of a substance is by no means made up exclusively of taste sensations in the special sense of this term. It is usually a complex of different sensations which almost invariably occur together. Only gradually do we learn to analyze this complex into its elements. Touch sensations of the tongue and palate often enter into the combination, for instance in a burning or astringent taste. Sensations of smell are of particular importance in this connection. The different kinds of meat, of wine, of bread, and of many other foods and beverages are distinguished almost exclusively by the smell. Aside from these accompanying sensations, there are only four tastes proper: sweet, sour, salt, bitter, in all their possible mixtures and relative degrees of intensity. In a manner comparable to the distribution of cutaneous sensations, the taste sensations have their end organs at definite points in the papillæ of the tongue and soft palate. The so-called taste buds contained in the walls of the papillæ seem to be sensitive according to the principle of the division of labor, some serving chiefly this, others chiefly that taste. It is possible that all the taste buds of the same papilla mediate the same taste sensation, so that each papilla might be said to be in the service of a particular taste.

The number of distinguishable odors is very large. Gaseous, fluid, and solid substances, minerals, plants, and

animals have usually their characteristic, although often very faint, odors. As new substances are discovered or new mixtures of substances invented, the number of odors is increased. Unfortunately it has thus far been impossible to arrange this multitude of odors in a system according to a simple plan. Various groups of related odors have been formed by investigators (for example, the odor of flowers, fruit, musk, onion, decaying matter). But it is difficult to include all possible odors in such groups; and the relation between these groups is still unknown. One reason for this difficulty in understanding theoretically the sense of smell is the obvious fact that this sense has degenerated in man. The organ of smell, a spot in the upper part of each nasal cavity, is of small extent in man compared with that of animals. Even more superior are the animals to man with respect to the development of the olfactory nerve center. The degeneration is the result of a lack of use. Man, walking upright, has but rarely an opportunity of approaching objects with his nostrils closely enough to be able to smell them. The animal, searching for food on the ground, smells unceasingly.

The opposite is true for color sensations. They, too, are numerous, perhaps a million. But it is easy to group them into a system which permits us to understand their interrelations. The relations between the various colors are so simple that they can be symbolically represented by a geometrical figure, a double pyramid with a four-cornered base, like the one in figure 14. The vertical axis represents the visual sensations which are colorless, arrayed so that the brightest white is at one end, the darkest black at the other, the various grays between. The base of the pyramids, which is not perpendicular to the axis, but slanting, represents the series of colors of



the spectrum plus the non-spectral purples, between red and violet, all arranged in an orderly manner around the axis. The nearer we approach the axis, the less saturated, that is, the more whitish, or grayish, or blackish are the colors represented. The most saturated colors are therefore represented by the peripheral line of the base. The base is slanted because the most saturated colors are not all of the same brightness (meaning by this term exclusively lightness as opposed to darkness). The saturated yellow is much brighter than the saturated blue and must therefore be located here, symbolically, nearer the point of white than of black, while blue must be located nearer the point of black than of white. The figure shows clearly that it is impossible to deviate from the peculiar brightness of each saturated color without diminishing the saturation, for we cannot move up or down from any point of the peripheral line of the base and yet remain within the double pyramid, without approaching the axis. But if our starting point is a color of less than the maximum of saturation, we may change the brightness within

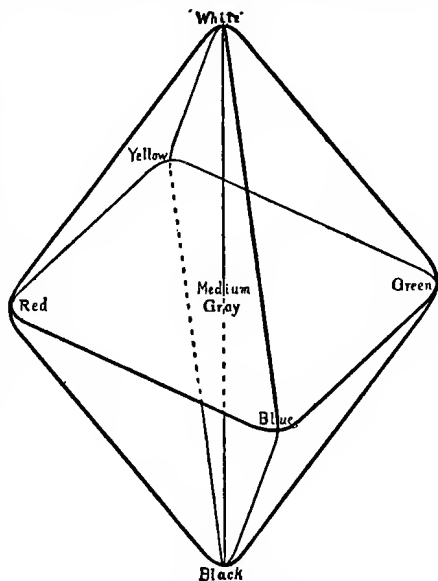


FIG. 14. — COLOR PYRAMID.

the figure shows clearly that it is impossible to deviate from the peculiar brightness of each saturated color without diminishing the saturation, for we cannot move up or down from any point of the peripheral line of the base and yet remain within the double pyramid, without approaching the axis. But if our starting point is a color of less than the maximum of saturation, we may change the brightness within

certain limits without changing the saturation, for we may then, to a certain extent, move up and down parallel to the axis.

Some have represented the color system by a double cone, using as common base a circle. But a four-cornered base represents an additional fact of experience which is lost sight of in the circular plane. The four colors red, green, blue, and yellow possess this property: that any one of them is entirely dissimilar in color tone to any of the other three, while any given color other than these must resemble just two of these. No other four or any other number of colors can be found which fulfill exactly these conditions. In order to represent this fact symbolically, we ought to give the colors red, green, blue, and yellow distinguished places in the periphery of the basal plane, and this can be done most easily by choosing as a base a four-cornered plane.

By the aid of this color system it is easy to understand an abnormality of our color sense which occurs rather frequently, so-called color blindness. It is found almost exclusively among men, three per cent of them being affected, whereas it is very rare among women, although it is inherited through woman. Instead of three dimensions, two are sufficient for the representation of the color sensations of such individuals: a plane which is placed through the points white, black, blue, and yellow. The color sensations represented by those points of the pyramid which lie outside the plane just mentioned appear to the color-blind person yellowish if they are located on either side of the yellow triangle, so to speak; they appear bluish if they are located on either side of the blue triangle, and colorless if located exactly on either side of the axis. There are, however, a large number of minor

differences not included or even expressed incorrectly in the above brief statement; the color-blind person, for instance, is more likely to see things yellowish than bluish. Since color-blind people may sometimes confuse such conspicuously different colors as red and green, they are often called red-green-blind. That they also confuse greenish blue with violet seems less remarkable to the normal person than the former fact. In testing a color-blind person one must not expect to find that he will confuse any red with any green. Brightness and saturation play here very important parts, and all kinds of individual differences have been observed. Nevertheless color-blind people fail to distinguish red and green much more frequently than people having a normal color sense, and should therefore be strictly excluded from any service in which the distinction of red and green is of importance, as in railway and marine signaling. For the normal person red and green are the ideal colors of signals, because yellow is not always sufficiently different from white, and a saturated blue is too dark.

It is interesting to observe that colors are never simple or complex in the sense in which a musical tone is simple and a chord is a multitude of tones, or lemonade is a mixture of sour and sweet. Any color sensation which is uniform over its area is as simple as any other. The colors which, in our color pyramid, are located between two of the four fundamental colors red, green, blue, and yellow are "mixtures" only in the sense that the mixed color *resembles* two of those four, not that we are conscious of two separate sensations in one act of perception.

Nevertheless we often have to speak of mixed colors and of principal colors entering into mixtures. These phrases have many different meanings. Most colors which we see in actual life are mixtures in a physical sense, mixtures of ether waves, although our sense organ does not inform us as to whether they are mixtures or homogeneous light. White or gray or purple can never be anything but mixtures in this physical sense. In actual life the only color which is often simple,

homogeneous light, is dark red, for physical causes which do not concern us here. But this physical complexity is irrelevant for the psychological question as to the simplicity or complexity of color sensation.

Even more confusion has been carried into the psychology of color by the fact that in dyeing and painting chemical substances are sometimes applied as they occur in nature or come from the factory, sometimes they are first mixed together and then applied. The painter cannot afford to have an infinite number of color pigments on the palette. He selects therefore a small number, at least white, red, yellow, and blue. This is for many ends sufficient, and he may therefore call these pigments his principal colors, and wonder why one should call green a "fundamental" color, since he can produce it by mixing blue and yellow. It is indeed no difficult task to find people who, like Goethe, are convinced that they are able to perceive in the green the yellow and the blue which the painter used in order to give us the impression of green.

Still another difference occurs in the use of the terms simple and mixed colors in physiology, with reference to the processes going on in the eye and the part of the nervous system connected with the eye. It is plain, therefore, that whenever we speak of colors we must state in what sense we do this.

Auditory sensations are usually divided into two classes: tones and noises. They do not often appear separately. A violin tone, for example, is accompanied by some noise, and in the howling of the wind tones may be discerned. Both may be perceived in many different intensities, and both may be said to be low or high. Many thousands of tones may be distinguished from the lowest to the highest audible. Within one octave, in the middle region, more than a thousand can be distinguished. The fact that in music we use only twelve tones within each octave arises from special reasons: first, the difficulty of handling an instrument of too many tones; and especially the fact that with a particular tone only a limited number of others can be melodically or harmonically combined with a pleasing result.

Just as the colors, so the tones are a continuum, that is, one can pass from the lowest to the highest tones without at any moment making a noticeable change. We refer to this continuum by the word pitch. But tones also possess what is called quality; that is, they are either mellow or shrill. This mellowness is to some extent dependent on the pitch of each tone, for low tones are never very shrill and high tones never very mellow. But to some extent a tone may be made more or less shrill and yet retain exactly the same musical value, the same pitch. This is brought about by the overtones, of which a larger or smaller number is nearly always added to musical tones. Without being perceived as separate pitches the overtones influence our consciousness of the mellowness of a tone — the fewer overtones, the mellow; the more overtones, the shriller the tone. Each musical instrument has its characteristic quality of tone, and in some instruments, especially in organ pipes, the quality is skillfully controlled by the builder, who "voices" each pipe so that it produces the required number of overtones of the right intensities.

It was said above that the overtones, as a rule, are not perceived as separate pitches added to the pitch of the fundamental tone. It is not impossible, however, to perceive them thus. Those who experience difficulty in perceiving the overtones as separate pitches may use at first special instruments, resonators, which are held against the ear and greatly increase each the intensity of a special overtone. After some practice one becomes aware of the pitch of an overtone without the aid of a resonator.

Noises may be classified into momentary and lasting noises. Examples of the former are a click and the report of a gun; examples of the latter, the roaring of the sea or the hissing of a cat. Many noises, as thunder, rattle,

clatter, and the noises of frying and boiling, are mixtures of momentary and lasting noises.

From all we have said it follows that the function of hearing is an analyzing function, enabling the mind to separate that which has lost its separate existence when it acts upon the tympanum. Two or three tones sounding together are usually perceived as two or three tones. In hearing music we can simultaneously listen to several voices. When two people talk together we may to some extent follow them separately. This is obviously an ability of great importance in animal life, since different objects, characterized by different tones or noises, rarely separate themselves spatially as the colors of different objects do, but act upon the sense organ as a single compound.

There are, however, certain exceptions to the analyzing power of the ear. If two tones differ but little in pitch, they are not perceived as two, but a mean tone is heard beating as frequently in a second as the difference of the vibration rates indicates. The ear thus creates something new, but of course something definitely depending on the external processes. If two tones not quite so close in pitch are sounded, one or even several new tones are created, combination tones or difference tones, the pitch of the new tone being determined by the difference of the rates of vibration. These difference tones do not seem to serve any purpose in animal life. They are merely secondary phenomena, of little practical consequence, but of much interest to the student of the function of the organ of hearing.

We have seen that the number of classes of sensations is fairly large; but to state this number exactly is impossible. According as we count the muscles, the joints,

the lungs, the digestive organs as several sense organs or as a single group, the number of classes of sensations is larger or smaller. However, it matters little whether we count them or not. We know that provision is made for everything needed. Information about the most distant things is obtained through the eye; information about the things in contact with the body or the body itself comes through the cutaneous and organic sense organs. Most varied is the information about things at a moderate distance, obtained through eyes, ears, and nose combined.

Many of the higher animals surpass man in one or the other respect through their sensory equipment. Many of the birds (for example, the carrier pigeons) have a sharper eye; dogs and other animals, a keener sense of smell. The sense of hearing in man seems to be equal to that of the higher animals, and the cutaneous sense perhaps superior. In one respect man is better equipped than his mode of living justifies, that is, in possessing the semicircular canals and the otolith organs, for which he has scarcely any use. In another respect he, as well as the animals, is very poorly equipped, that is, for the direct perception of the electromagnetic-optic phenomena of physics, only a small range of which can be perceived as a particular kind of sensations, namely, as colors.

### *3. Temporal and Spatial Attributes*

The study of the simple in mental life, as previously mentioned, is always a study of abstractions. The actual experience even of the briefest moment never consists of a single sensation. And actual sensations are always characterized by more than the properties which we have thus far discussed. Colors always occupy space of a cer-

tain size and shape; tones come from a certain direction; both colors and tones are either continuous or intermittent, they are perceived simultaneously or in succession. We naturally inquire into the laws of these spatial and temporal relations. Unfortunately psychologists have not yet agreed on a definite answer to the question concerning space and time. The question is beset with difficulties, partly real, partly imaginary.

Is it possible to perceive temporal relations as sensory qualities as we perceive colors, tones, tastes, and smells as sensory qualities? We certainly lack a sense organ of time. But aside from this, it seems impossible to perceive duration at its beginning, when the end is not yet known; impossible to perceive it at the end, when its beginning no longer exists and can only be recalled in memory. It seems equally impossible to get direct knowledge of a spatial relation. Imagine one particular point  $a$  of the skin or the retina of the eye. If this is stimulated, our mind receives a definite impression of touch or color, but no indication of or reference to any other point, since no other point is stimulated. Let the same be true for the point  $b$ . How, then, if  $a$  and  $b$  are stimulated simultaneously, can the mind receive an impression of distance between the two points, since there is no such consciousness in the perception of either of them? If the mere fact of an objective distance between the stimulated neurons were a sufficient explanation, then tones too should be localized differently.

Those who took these objections seriously tried to think of some means by which the objective, but not directly impressive, spatial relations could become known to the mind. It was suggested that the almost unceasing movements of the eyes and fingers, the chief organs of space



perception, might have significance in this connection; that perhaps the kinesthetic sensations of eye and finger movement, being added to the visual or tactual impressions, made up the consciousness of spatial relationship.

All attempts, however, to prove the correctness of this and similar theories by applying them to the details of special experience, have failed. While there is no doubt that movements of our eyes and fingers are of great importance for the development and extension of the spatial consciousness in the individual as well as in the race, they are not the source from which springs the individual's ability to perceive spatial relationship. The fundamental part of our ability of *spatial* perception is inborn, just as our ability to perceive light or blueness or cold is inborn. From this inborn capacity for spatial perception the individual's delicate and elaborate sense of space is derived.

The most convincing proof that there is an innate capacity for spatial perception, is the spatial consciousness of persons born blind, to whom an operation has given eyesight. The crystalline lenses of these persons have been as little transparent as ground glass, so that they have been unable to recognize any outlines of things. Nevertheless, they make spatial distinctions immediately after the operation for removal of the lens. Of course they cannot, without further experience, tell that a round thing is the ball with which they have been familiar through the sense of touch, or a long and narrow thing a walking stick. But they immediately perceive the round thing as something different from the long and narrow thing, without any tendency to confuse them. Spatial extent is therefore an attribute of visual and tactual sensation as brightness or darkness is an attribute of visual sensation, and mellowness or shrillness an attribute of tone; with

this difference only, that spatial extent is not restricted to one sense, but is common to visual and cutaneous sensations. That this is founded on some kind of similarity of these senses cannot be doubted. But this similarity is to be looked for in structural peculiarities of the nerve centers, not in accessory mental states serving as special agents of spatial consciousness.

Very much the same is the case with time. Let us admit that the temporal consciousness of our ordinary life is largely mediated by accessory sensations and images. Minutes, hours, days, weeks, are not experienced directly as properties of sense perception, but are extensions of simpler experiences. But such extensions would be impossible if duration and succession were not, somewhere in our mental life, direct experiences. They are direct experiences in some very brief temporal perceptions occupying, say, only a fraction of a second. The flash of a lighthouse signal, the quick succession of sounds when a person knocks at a door, are perceived as having temporal attributes without any mediation by conscious states acting as agents. The *temporal* attributes are elements of perception no less direct than the intensity of the light or of the sound. The same holds for all other sensations. Time is an attribute common to all. But here, as in space, we cannot tell exactly in what respect all senses are similar so far as the nervous processes are concerned. It seems that these processes or their after effects continue a certain time after the stimulation has ceased.

Another attribute common to all sense impressions is the belonging-together of sensations, the *unity in variety*, so to speak. The most striking example is the relationship of tones in harmony and melody. Tones of certain comparatively simple ratios of vibration belong together in a higher

degree than others. We cannot explain this by reference to conscious agents mediating the effect. It is a fundamental attribute of each tonal combination, the conscious effect of our inherited nature. It is a property of sense, not of thought.

In other cases our consciousness of relationship is indirect, mediated by other conscious agents; for instance, when I group together voluntarily four or five adjoining holes of a sieve and perceive them as a unit. This grouping together would be impossible if the mind did not possess the native ability to perceive a number of sensational elements as a unit without altogether losing the consciousness of variety. It is a mere consequence of our inborn nature when we perceive as such units, for example, an animal romping among unchanging surroundings, a picket fence divided into groups by the fence posts, a familiar compound perfume, a dish made up of several familiar food substances. The same holds for successive elements. We could never perceive tones or noises in various rhythm forms if our mind did not possess the native ability to perceive a number of successive elements of sensation under certain conditions as a sensory unit.

Our numerical concepts are obviously only abstract symbols for units containing each a certain variety of elements.

#### 4. *Sensation and Stimulus*

It is most interesting to observe the astonishing *absolute sensitiveness* of some of our senses, that is, their ability to respond to exceedingly small stimuli. It has been a difficult task to design physical instruments as sensitive to sound as the ear. It has not been possible, thus far, to surpass the ear. The sensitiveness of the eye to the faint-

est light is estimated to be a hundred times that of the most sensitive photographic plates. Remember what a long exposure is necessary to photograph things in a rather dark room; but the eye takes a snap shot, so to speak, of a star of the fifth magnitude, or of a landscape in diffused moonlight. Man's organ of smell is far inferior to that of many animals. Nevertheless a trace of tobacco smoke or musk in the air whose presence no chemist could detect is easily perceived through the nose. A gram is about one twenty-eighth of an ounce; a milligram is one thousandth of a gram. One millionth of a milligram of an odorous substance is sufficient to affect the organ of smell. Taste also is sensitive, particularly when supported, as in tasting wine or tea, by smell. The cutaneous and kinesthetic senses, on the other hand, are not very sensitive. A weak pressure, a small weight, a slight tremor of our limbs, a spatial extent, can be detected much more readily by delicate instruments than by our fingers or our kinesthetic organs.

Very important is the range of perceptibility. Our measuring laboratory instruments are, as a rule, adapted only to a small range. To weigh a heavy thing, like a stack of hay, we have to use a balance differing from that used by the prescription druggist. The watchmaker's tools are much like those of the machinist, but neither could use the other's tools. Nature cannot well provide separate sets of tools for delicate and gross work. With our hand we estimate the weight of ounces, pounds, and hundredweights. The same ear which perceives a falling leaf can be exposed to the thunder of cannon without ceasing to respond in its normal way. The eye which perceives a small fraction of the light of a firefly, can look at the sun somewhat covered by mist, radiating light many million

times as intense. No laboratory instrument has an equal range of applicability.

This wide range of usefulness is made possible partly by purely mechanical provisions, partly by a special law of nervous activity usually called Weber's law. The iris of the eye with pupil in the center is a readily changeable diaphragm. The stronger the external light, the smaller the pupil, and the reverse; so that the eye is capable of functioning at a stronger and also at a fainter illumination than it could function if the width of the pupil were of a medium, unchangeable diameter. The nose can smell faint odors better if larger quantities of the odorous substances are by sniffing brought into contact with the organ. Too strong odors are kept away by blowing out the air.

More important, however, than such mechanical devices is the effect of Weber's law. If a stimulus is increased, the nervous excitation is also increased,—not absolutely, but only relatively to the stimulus before the increase. Suppose an oil lamp of ten candle power needs an addition of a two candle power light to make me observe that the illumination has changed. Nevertheless I shall not be able to observe a change of illumination if to an incandescent gas light of sixty candles two candles are added. The addition must be in proportion to the stimulus. Since sixty is six times ten and twelve is six times two, twelve candles must be added to make me observe the difference in illumination. To an arc light of two thousand candles four hundred have to be added to obtain the same result. If a postal clerk is able to recognize that a letter which he weighs on his hand and which is one twentieth heavier than an ounce, requires more than the one postage stamp attached to it, he will probably be found capable of observing in the same

manner that a package of newspapers prepaid for one pound does not have the correct number of stamps if it is actually one twentieth heavier than a pound.

Another way of speaking of the law is this: If we imagine a definite stimulus successively increased by such amounts that the change of the sensation is each time just as noticeable as it was the last time, the added amounts of the stimulus are a *geometrical progression*. Let us express the fact that the change of the sensation can always be noticed *with the same ease*, by saying that the additions to the sensation are an arithmetical progression. We can then state Weber's law in these simple words: If the sensation is to increase in arithmetical progression, the stimulus must increase in geometrical progression. This statement is mathematically identical with the most widely adopted statement of the law, namely, that *the sensation is proportional to the logarithm of the stimulus*.

The practical result of the law in our mental life is this: The mind is informed of a further increase in the intensity of the stimulus (however great this intensity may have become before this last increase) without having to respond to the absolute intensity of the stimulus with a correspondingly enormous activity of the animal organism. Thus the mind is enabled, figuratively speaking, to weigh a stack of hay or a druggist's herb on the same balance, to apply the same tool to a watch or to a railroad locomotive, or at least to perform its work with a much smaller number of tools than would otherwise be required. In the eye, for instance, we have, as we see below, only two different kinds of receiving instruments for faint and for strong light.

It must be mentioned, however, that Weber's law does not hold good over an unlimited range of intensities of stimulation. If the sun

were twice as bright, it would not appear brighter to the eye. For such extreme intensities the law is no longer valid. Neither is it valid for exceedingly low intensities ; it makes no difference to the eye whether the wall of a dark room is illuminated from a distance of three or four yards by the glow of one cigarette or a dozen. The logarithmic equation applies only to a certain — quite large — range of medium intensities. For this range our sensitiveness to change is not only constant, but also greatest. Changes in illumination within this range can be perceived as soon as the stimulus increases or decreases by about one hundred and fiftieth.

Weber's law has still another practical significance. A thing which we recognize by the aid of the differences in illumination of its parts (as, for example, a stone relief) or by its differences in loudness (as a rhythm beaten on a drum) always retains, not the same absolute differences, but the same quotients or proportions of the different light or tone values, however our distance from the thing varies. Weber's law, then, enables us to perceive the identity of the thing although the absolute light or tone values have undergone change. If our nervous activities were not regulated in accordance with Weber's law, the relief and the rhythm might become unrecognizable at a greater distance, and the relief also at dusk.

A further important relation between our mental life and the external world consists in our much greater sensitiveness to the moving and changing than to the stable and permanent. A pencil point moved over the skin under slight pressure gives us a perception of the length and direction of the line traversed more accurate than the impression received from the edge of a screwdriver pressed on the skin. On the peripheral parts of the retina the sizes and distances of things are not easily perceived ; but no difficulty is experienced in noticing a waving handkerchief or a starting animal. Only the small central part of the retina is adapted to the perception of the motionless.

The same statement holds for qualitative changes. The eye is not only more sensitive to that which qualitatively changes than to that which remains unchanged ; it even

loses its ability to perceive things if for a considerable time no qualitative changes occur. We have seen that our eye can take snap shots under conditions which would make this impossible for the photographic camera. But for time exposures, like those used in photographing faint stars, continued for hours, our eye is not suited. The eye, in such a case, would soon cease to distinguish anything. The eye completely fixed upon one set of objects soon sees their lighter parts darker, their darker parts lighter, their colored parts less colored — more grayish — that is, it sees everything gray on gray. This is technically called adaptation of the eye. Moving the eye suddenly, we become aware of this adaptation in peculiar after-images.

Similar adaptations occur in other sense organs. Constant pressure on the skin, unchanging temperature of not extreme degree, permanent odors, cease to be perceived. But what is new, what differs from the condition which was in existence just before, is perceived at once; and because of the sense organ's adaptation for something else, as a rule it is seen with particular intensity. This is obviously the most favorable equipment for a struggle for life. Nothing is more dangerous in battle than surprise.

Our present knowledge of the mechanical, chemical, and physiological laws governing the peculiar dependence of the different kinds of sensations on special properties of the sense organs—that which is customarily called a theory of vision, a theory of audition, and so on, is rather unsatisfactory. Some thirty years ago much seemed to be perfectly explained which has since become mysterious again. This much has been learned, that the laws in question are far more complex than they were believed to be.

Only one statement about eyesight can here be made



without fear of contradiction, that is, that the eye is a double instrument, one part of the organ serving in daylight, the other at dusk and in twilight. But this explains only a part of the total function of the eye. The retina of the eye consists of a great number of elements called rods and cones, forming a kind of mosaic. Twilight vision is served by the rods, which contain a sensitive substance called the visual purple. Most of the rods are in the peripheral parts of the retina, becoming less numerous toward the center. In the central area there are no rods at all. The only service of the rods is the mediation of a weak bluish-white sensation of various intensities, as in a moonlit landscape. Ordinary day vision is served by the cones, which are the only elements present in the center and become rare towards the periphery. All the variety of our color perception depends on the cones. In very faint illumination the colors of things cannot be perceived, although the things may still be distinguished from other objects. The rods alone are functioning then; the cones have "struck work." Neither can the shape of things be perceived in dim light with normal definiteness, because the area of most distinct vision, the central area, contains only cones; reading, for instance, is impossible at twilight. The astronomer, in order to observe a very faint star, must intentionally look at a point beside the star, because of the lack of rods in the central area.

While the human eye normally possesses both rods and cones, certain species of animals have only one or the other kind of visual elements. Chickens and snakes possess only cones. This is the reason why chickens go to roost so promptly when the sun sets. Night animals, on the other hand, have mostly rods and few cones. This explains why bats come out only after sunset. In very rare

cases human beings seem to possess only the rods, in cases of total color-blindness. The whole world appears colorless to them, only in shades of gray. They dislike greatly to be in brilliantly lighted places. They lack the keenness of normal eyesight because of the deficient function of the central area of the retina, which is normally best equipped.

A mechanical theory of hearing was worked out by Helmholtz nearly fifty years ago. This theory was at first generally accepted, but has in recent years lost much of its plausibility. The inner ear is a tube coiled up in the shape of a snailshell in order to find a better place in the lower part of the skull. Its coiling, of course, has little if any mechanical significance. The tube is divided into two parallel tubes by a kind of ribbon, the organ of Corti, containing the endings of the auditory neurons and also a comparatively tough membrane. Helmholtz made the hypothesis that the cross fibers of this membrane were under constant tension like the strings of a piano. The comparison with a piano was also suggested by the fact that the membrane in question tapers like the sounding board of a grand piano. As the piano resounds any tone or vowel, so this system of strings would resound any complex sound; that is, each of the tones contained in the complex would be responded to by those fibers whose tension, length, and weight determine a corresponding frequency of vibration. The analyzing power of the ear is well explained by this hypothesis, but there are considerable difficulties left. For instance, the fibers of the membrane, even the longest, are rather short for the low tones to which they are assumed to be tuned. And for the assumption of a constant tension of these fibers there is no analogon in the whole realm of biology, since living

tissues always, sooner or later, adapt themselves and thus lose their tension.

Another theory avoids these difficulties by merely assuming that the ribbon-like partition of the tube, when pushed by the fluid, moves out of its normal position only to a slight extent and then resists, and that therefore the displacement of the partition must proceed along the tube. If successive waves of greater and lesser amplitude, as we find them in every compound sound, act upon the tympanum and indirectly upon the fluid in the tube, the displacement of the partition must proceed along the tube now farther, now less far, now again to another distance, and so on. Accordingly, one section of the partition is displaced more frequently, another section less frequently, others with still different frequencies in the same unit of time. This theory then makes the hypothesis that the frequency with which each section of the partition is jerked back and forth determines the pitch of a tone heard, and explains thus the analyzing power of the ear. What is chiefly needed in order to decide in favor of either of these or any other theory is a large increase in our knowledge through anatomical, physiological, and psychological investigation.

### QUESTIONS

46. What are the newly discovered kinds of sensations?
47. How were they discovered?
48. What are the cutaneous senses?
49. What is the objection to speaking of the cutaneous sense as one?
50. What is pain?
51. Of what importance are the labyrinth senses (other than hearing) to man and various animals?
52. What is meant by organic sensations?
53. What are the four tastes?

54. How does the sense of smell in man compare with that of animals?
55. Why is the color pyramid superior to the color cone?
56. What are the chief symptoms of defective color vision?
57. What is not meant, and what is meant, by color mixtures?
58. Why does music use only twelve tones?
59. What is meant by the qualities of the tones of various instruments?
60. Are there any limits to the analyzing power of the ear?
61. What is the exact number of classes of sensations?
62. How does the sensory equipment of man compare with that of the animals?
63. What do we learn from experiments on blind-born persons who have been operated on?
64. In what experiences is time an attribute of sense perception?
65. Is tone relationship a property of sense or of thought?
66. Can you illustrate the absolute sensitivity of our sense organs?
67. How does the range of applicability of our sense organs compare with that of tools and instruments?
68. Can you illustrate Weber's law?
69. What are the practical advantages obtained through Weber's law?
70. Illustrate sensitiveness to change and movement.
71. How is the chief difference in the behavior of chickens and bats to be explained?

## § 5. IMAGINATION

Mind is influenced not only by that which is present, but also by the past and — one may say — the future, and by that which exists at another place. Consciousness of this kind is called imagery. I imagine a lion and recognize that he looks different from a horse. I recall the room in a hotel where I have recently spent a night and see that it differs from my study.

Imagery does not differ in content from percepts. There are as many kinds of images as there are sensations,

and their attributes are the same. Imagination differs from perception only through its independence of external conditions in the formation of new combinations out of the sensory elements which have previously been experienced. Although the kinds of content of imagery do not differ from those of perception, imagery differs from perception, as a rule, in such a characteristic manner that in ordinary life we are not likely to mistake an image for a percept or a percept for an image. The imagined sun lacks brilliancy. Its imagined heat does not burn. A glowing match, perceived, surpasses those images. Only in childhood, in dreams, and in particular individuals (artists, for example), and under particular circumstances (like the imaginative supplementing of that of which only parts have stimulated the sense organ) can imagery come near being compared and confused with percepts. Generally the difference in *vividness* remains great. A second difference is the lack of *details* of images. As a rule only a few parts of a rich complex of sensations reappear when an image takes the place of the original percept. And the selection of these details is usually most grotesque. A third characteristic of images is their *instability*, fleetingness. Compared with the persistence of a percept, an image can scarcely be said to have any definite make-up since its composition changes from moment to moment. Images come and go in spite of our desire to keep them. They change like kaleidoscopic figures.

All this has its disadvantages ; but also its great advantages. Being at once pictures and mere abbreviations or symbols of things, images aid effectively in our handling of things. If they were exactly like percepts, they would deceive us, as hallucinations do. Their very lack of details and their fleetingness enable our mind to grasp a greater

multitude of things, to adjust itself more quickly and more comprehensively to its surroundings.

Independence of external causes and frequent recurrence from internal causes give to our imagery the character of a permanent possession of the mind. Not every part of this imagery is actually made use of, since these parts are too numerous, but every part is always available for use. This leads to the question as to the nature of the images while mind is not conscious of them, particularly the nature of their nervous correlate. Ever since the discovery of ganglion cells and nerve fibers the naïve conception has readily offered itself that every idea has its residence in a little group of cells, the idea of a dog in one, the idea of a tree in another, and so on. Some have calculated the number of cortical cells which would be necessary in order to provide a sufficient number of residences for all the ideas acquired by a human being during a long life. They have found that the cortical cells are numerous enough.

But the matter is not quite so simple. Our ideas, being made up of many mental elements, overlap. If the idea of a dog has its residence here, the idea of a lion its residence there, where, then, do we find the idea of a carnivore, the idea of another kind of dog, the ideas of the individual dogs known by me, the ideas of other carnivora, the idea of a mammal, of a vertebrate, of an animal in general? These ideas are interwoven in such manifold ways that it is difficult to assume that each should have its separate residence in the brain. It is still more difficult to apply this theory to the idea of barking, which can be imitated by man, being natural to a dog; or to the idea of white, which belongs to some dogs, but also to the clouds, the snow, the lily.

There are also anatomical difficulties. I look first at

a dog, then at a goat. The elements of the retina which are stimulated are largely the same in both cases. This makes it difficult to understand why the nervous processes in the former case should all concentrate in one point of the cortex and in the latter case in an entirely different point. Or I hear the word *boxwood* and later the word *woodbox*. The anatomical difficulty is the same.

The nervous correlates of ideas are obviously much more complicated than the theory of location in cell groups assumes. There can be no doubt that the nervous correlate of an idea, even of an elementary image, is a process going on in a large number of connecting neurons in the higher nerve centers, often widely distributed, like the meshes of a net. The individual neurons in question do not belong exclusively to this one idea, but, entering into numerous other combinations with other neurons, belong to numerous ideas. The nervous correlate of a latent idea, which is not conscious but ready to enter consciousness at any time, is not a material substance stored away somewhere, but a disposition on the part of neurons which have previously functioned together, to function again in the same order and connection.

### QUESTIONS

72. In what respects do images not differ from percepts?
73. In what three respects are images as a rule distinguishable from percepts?
74. What are the advantages of the characteristics of images?
75. What is the nervous correlate of imagery?
76. What is the nervous correlate of a latent idea?

### § 6. FEELING

Sensations and their images are closely related mental states. They are of the same kind. As a third class of

elementary mental states the feelings of pleasantness and unpleasantness are customarily added. But it would probably be more correct to say that these feelings are mental states of an altogether different kind, in comparison with which the distinction between sensations and images disappears. Pleasantness and unpleasantness never occur apart from sensation or imagery, whereas the latter states of consciousness may be free from any pleasantness or unpleasantness. The pleasantness which I experience is always the pleasantness of something — of the taste of a peach, or of my good health, or of a message received. However, we must not conceive this dependence of pleasantness and unpleasantness as similar to the dependence of color or pitch or spatial extent or duration on the thing to which these belong as its qualities. Color, pitch, and these other qualities are essentially determined by objective conditions, the physical properties of the thing in question. But pleasantness or unpleasantness is only to a slight extent, if at all, determined by objective conditions. Honey tastes very much the same whenever we eat it. A tune sounds very much the same whenever we hear it. But these sensory experiences are, in consequence of subjective conditions, now highly pleasant, now almost indifferent, now decidedly unpleasant.

The same colors and straight lines may be combined into a beautiful design or into an ugly one, the same descriptions of scenery and events into an attractive or a tedious book. A feeling which is already in existence may prevent the growth of an opposite feeling. On a rainy day we are likely to feel as if everything in the world were gray; on a sunny spring day as if everything were rosy. The grief-stricken or desperate person experiences a given situation with other feelings than the person



full of joy or hope. A particularly strong factor in our life of feeling is the frequency of recurrence of a situation. The most beautiful music suffers from being played at every concert and on every street, the most delicious dish from being put on the table every day. On the other hand, a bitter medicine gradually loses its unpleasantness, an unpleasant situation becomes indifferent to a person whose profession compels him to face it frequently. As the unchanging is at a disadvantage in our life of perception, so is the recurrent in our life of feeling.

The subjective factor which determines what feelings accompany our perceptions may be defined as the relation of the situation perceived to the weal and woe of the organism. Pleasantness indicates that the impressions made upon the organism are adapted to the needs or capacities of the organism or at least to that part of the organism which is directly affected; unpleasantness indicates that the impressions are ill adapted or harmful. Exceptions to this rule may be explained through the great complexity of the situations by which the organism is often confronted, and through the complications resulting from the fact that the organism must adjust its activity not only to the present but also to the future, and not only in harmony with the present but also with past experience. Feeling is a reliable symptom and witness only for the present and local utility or inadequacy of the relation between the organism and the world. It is not a prophet of the future. Disease may result from eating sweets, whereas medicine is often bitter.

The addition of feeling to our perceptions and images, because of the peculiarities just mentioned, brings about great complications in the make-up of our mental states and increases enormously the task of classifying and com-

prehending our states of consciousness. The feelings accompanying images are originally the same as those which accompanied the perceptions in question. The memory image of the pain of flogging is unpleasant because the original pain was unpleasant. But the manifold connections of the images often result in unexpected feelings. The memory of an unpleasant experience may become a source of pleasure through the additional thought that the experience was the result of some folly of which one is no longer capable. The feeling accompanying a perception can change in a similar manner. A saturated green, as the color of a pasture or of an ornament, is pleasant; as the color of a girl's cheek it would be highly unpleasant.

Not only are perceptions and images themselves sources of pleasantness and unpleasantness, but also their relations, spatial, temporal, and conceptual. The pleasure which we derive from looking at a picture or a landscape illustrates the dependence on spatial relations. The pleasure of a symphony or dramatic performance depends largely on temporal relations. Jokes and puzzles please us chiefly because of their conceptual, logical relations. It is plain, then, that every complex of sensations, supplemented by a large number of images, must become a stage, so to speak, on which countless scores of feelings play their parts. In so far as their perceptual and ideational bases may be kept apart, we may count as many of these feelings as we distinguish percepts or ideas. In so far as all these feelings are either pleasantness or unpleasantness, we may speak of the feelings as being only two in number. This may explain to us why such mental states as love, pride, sentimentality, the joy of the audience in a theater, the interest of the reader of a biography,

appear at once simple enough, unitary enough, and yet inexhaustibly replete with contents and difficult of comprehension. This also explains the opposite views of so many writers, of whom some assert that the number of feelings is infinitely large, others that there are only two, pleasantness and unpleasantness, which may accompany an infinite number of sensation complexes. The difference between these writers is much less than appears from their words.

### QUESTIONS

77. How are pleasantness and unpleasantness related to sensational states of consciousness?

78. How are pleasantness and unpleasantness related to objective conditions?

79. How does the repetition of an experience influence its pleasantness or unpleasantness?

80. What is the general subjective condition of pleasantness and unpleasantness?

81. Is feeling a prophet of the future?

82. What difficulties does the existence of feeling cause the psychologist?

83. Are there more than two feelings?

### § 7. WILLING

Willing is usually mentioned as being a distinct class of mental states. However, willing is not a special class in the sense in which perceptions, images, and feelings are called classes. To understand willing, let us consider certain typical actions of an infant which are based on inborn nervous connections. What do we mean by the feeding instinct? We mean unpleasant sensations of hunger and thirst followed by various movements of arms

and legs, of crying, of sucking, until the unpleasantness of the situation ceases. The movements themselves are nothing mental. But while they are occurring they become known as kinesthetic sensations, partly also as visual or auditory sensations. Two classes of sensations may therefore be distinguished in any instinctive activity: those which correspond to the sensory phase of the reflexes in question, and those which result from the reflex movements. After frequent occurrence of these reflex movements, images of various parts of the whole satisfying process remain, and these, or some of them, become conscious even before any of the movements occur. For example, as soon as hunger is experienced the infant has also an image of the bottle, of the mother bringing it, of his own movements of grasping, sucking, and so on. The instinctive act has then been replaced by an act of will. *Willing, therefore, may be defined as instinct which foresees its end.*

No new kind of mental state can be discovered in willing. There is nothing but sensations, feelings of pleasantness-unpleasantness, and images. If we give to such a combination of these three kinds of mental states the name of willing, we justify this new name by the fact that such combinations are the most original, the earliest conscious states which have occurred in our mental life. The first consciousness accompanies instinctive activity, and immediately a simple form of willing is made possible. From the genetic point of view, that is, if we are interested in the growth of our consciousness, willing is the most elementary form of consciousness. Perceptions, images, and feelings did not exist separately for some months or years to become afterwards united into willing. Willing was there when consciousness first awoke. On the other hand, if we are interested in describing the make-up of our pres-

ent mental life, — that is, from the point of view of the psychologist searching for concepts of mental states, — sensations, images, and feelings are the most elementary forms of consciousness.

There is no will in the sense of a simple faculty, always remaining identical with itself, merely changing its direction and now applying itself to this thing, now to that thing. Will is an abstract word, referring to that which is common to all states of willing; but, like all abstractions, it does not possess any real existence apart from the realities from which it has been abstracted, that is, from the particular cases of willing occurring in each person's life. Of course, there is no objection to using the abstract word *will* without explaining each time that it is an abstraction. We need not hesitate to refer to typical differences between the cases of willing most frequently observed in one person and those observed in another by saying that one has a strong will, the other a weak, a vacillating will.

### QUESTIONS

- 84. How may willing be defined?
- 85. Is willing an elementary kind of consciousness?
- 86. Why is it wrong to answer the preceding question simply by yes or no?
- 87. What is the will?

## *B. THE FUNDAMENTAL LAWS OF MENTAL LIFE*

### § 8. ATTENTION

A ship, under the influence of several forces — the screw, the wind, the current — follows all of them simultaneously, and the place which it reaches after a certain time is the same as that which it would have reached if these forces had acted, each for the same length of time, but one after

the other. External things, whenever they are under the influence of several forces, are governed by the law of the resultant. The mind's mode of response is entirely different. When there are many things to see, as a crowd of actors on the stage, many things to hear, as a chorus and orchestra, and in addition some whispered words of our neighbor, the result is by no means the same as if all these impressions acted upon our mind successively. If time enough is given, our mind will successively respond to each of these impressions of sight and hearing. But if the response must occur quickly and be done with, it is restricted to a part of the impressions made by the external objects. A few of these impressions, specially favored by circumstances, affect our consciousness at the expense of the others. The latter are not entirely lost for our mind; but they fail to call forth separate responses, they fuse into a mere background upon which the favored impressions make their appearance. They are often spoken of as the fringe of the clearly conscious mental states.

One might call this selective effect the narrowness or focalness of consciousness; in ordinary life it is called attention. We say that attention is given to certain contents, and that the others are not attended to, that they are under the influence of inattention. There is no similar phenomenon in the whole inorganic world. In our mental life nothing is more ordinary. I look up and notice many things. But many more are projected upon my retina without succeeding in becoming noticed. When reading a book I cannot accomplish everything that I wish I could. Giving attention to the meaning, I fail to become conscious of the beauty of style. Looking for typographical errors, I fail to understand the logical connection of the sentences. For each purpose a new reading is necessary. Mental work

requires the exclusion of piano music and crying babies. Thinking is not so easy while we are performing a gymnastic feat or walking at a rapid gait. When we are listening to difficult music, we shut our eyes. When a momentous question, a dangerous task, presents itself, we are in danger of losing our head; that is, being occupied by ideas of the magnitude of the event, we fail to become conscious of thoughts and memories of the simplest and most ordinary kind.

The popular view of attention is that it is an independent being, separate from the contents of the mind. Attention stands at the helm, and as the mind desires these or those contents, attention changes the ship's course. This, of course, is pure mythology. The enhancement and impairment of impressions to which we refer in speaking of attention and inattention are not a peculiar activity of mind; they are simply the effects of peculiar relations existing between the impressions themselves. A few of these relations may be briefly discussed.

Whatever situation is capable of being a source of pleasantness or unpleasantness, is also likely to become enhanced in vividness, so that one may say that the value of an impression for our life of feeling is one of the factors determining attention. Any remark of a person near by, although merely whispered and hardly perceived by others, quickly rises to a high degree of consciousness in my mind if it concerns my reputation. That which we have experienced frequently, no longer causes much pleasantness or unpleasantness; and in accordance with this, it is not likely to be attended to.

This parallelism between feeling and attention is expressed in the word *interest*. We are interested in those things which conform to our habits of thinking. Because

of this conformity they are useful to us at the present moment of our life, and therefore pleasant. Because of this conformity with our habits they become vividly conscious — they are attended to. What is unrelated to our habits of thinking is not useful to us at the moment and is therefore indifferent; and being unrelated, it attracts no attention. Everybody knows how readily the average member of a political party assents to the assertions made by the party leader, how readily the adherent of a religious faith accepts instances proving its correctness, how he unintentionally ignores anything which he cannot accept without opposition or discomfort.

Another factor determining attention is the relation of a new impression to the thoughts occupying the mind at the moment when the impression was made. That which is conscious prepares the path over which everything related may enter. Ordinarily the ticking of a clock remains unnoticed. But let the person think of the clock, or of time, and the next tick is clearly perceived. In order to notice a weak tone in a complicated chord, or a melody in polyphonic music, it is well to hear the tone or the melody first in isolation and try to keep it in mind until the chord or the music is played. A slight difference in the color of two leaves remains unnoticed; but if we are thinking of a color difference just before the leaves are shown to us, it becomes at once vivid in our consciousness. The puzzle pictures common in certain popular magazines would never convey the intended meaning to us, if we were not invited by the text to think of various things which they might represent. If we know beforehand in what order a lecturer will present his arguments to us, we can pay attention to the lecture much more easily and understand it better.



Attention is usually accompanied by numerous instinctive muscular activities, which contribute toward the continuation and toward a greater distinctness or intensity of the impression. When our visual organs are stimulated, the head and the eyes turn so that the impression may be received at the point of keenest vision. If the ear is stimulated, the head turns so that both ears assume the most favorable position with respect to the source of sound. When images occupy the mind, the eyes are directed at an indifferent, uninteresting object, or they are closed, the lips are pressed together, the limbs assume a position of rest. All this tends to keep away avoidable stimulation of the sense organs of the body. These instinctive movements are, of course, perceived as kinaesthetic sensations, as varied forms of strain, of activity. Thus they give rise to the erroneous view that attention is a peculiar activity of the mind's own content. This view is most emphatically expressed in the phrase "voluntary attention." It often happens that we become conscious of the muscular adaptation characteristic of attention before the mental state to which attention is given has appeared. For example, we see lightning and at once imagine the thunder and the muscular adaptations of the ear and other parts of the body which generally occur when it thunders. Or we hear our teacher's voice telling us that he will give an explanation, and we imagine the strain, the activity of our muscles, which begins as soon as he starts giving the explanation. This foreseeing of our activities we have above called willing. *The foreseeing of our attention is the will to give attention, is voluntary attention.*

It is a peculiar fact that vividness of a certain thought or even a class of thoughts is never much prolonged.

Other impressions or ideas take the place of those which are now focal. Under the most favorable conditions, the same ideas reappear again and again. This limited duration of attention is most conspicuous in children and is one of the greatest obstacles which the teacher has to overcome. Repeated orders to be attentive are of small value. They tend to call up a general notion of the matter which is being taught, and thus make it easier for the ideas presented by the teacher to enter consciousness. But the effect is not lasting because the very thought of being attentive cannot itself have a long duration. It is therefore preferable to take into account the nature of attending, and in accordance with it, to provide a certain change in the ideas presented—to present the matter in an interesting way.

### QUESTIONS

88. What essential difference between mental function and mechanical function is referred to by the word *attention*?

89. Can you illustrate the chief facts of attention and inattention?

90. Can you illustrate the parallelism between the laws of feeling and of attention?

91. How is attention mentally prepared for?

92. How is attention assisted by special muscular activity?

93. What causes the illusion that attention is a voluntary activity of the mind upon its contents?

94. What practical problems are connected with the law of the duration of attention?

### § 9. MEMORY

While attention means limitation, memory means expansion. From the enormous number of impressions calling simultaneously for response, the mind selects a small group of those related to its present needs. But the mind may go beyond the limits of that which is presented

and respond to impressions of a former time. We then speak of memory. When I hear the first verse of a poem which I have previously heard or read more than once, I continue to hear, in imagination, the following verses although the reader has stopped. When I see a black cloud drawing over the sky and the trees bowing under the pressure of the wind, I know that a thunderstorm is approaching. When I smell carbolic acid or iodoform, I look for a person wearing a bandage. In every case the mind tends toward expansion beyond the limits of the data presented at the moment. The mind thus restores the connections in which the accidentally isolated object of present interest has been experienced with other objects in the past.

We refer to this ability of expansion by the term *memory*, to the actual process of expansion by *reproduction* or *association*. The immense importance of memory for life is easily understood. Nature repeats itself—not without some variations of the accompanying phenomena; but no group of phenomena, aside from such variations, fails to recur at frequent intervals. In reproducing what previously existed under similar conditions, our mind possesses, as a rule, a real knowledge of what now exists but happens to remain hidden, and of what is about to occur. Thus our mind adapts itself to those parts of the world which are for spatial or temporal reasons beyond the reach of our sense organs.

A special case of reproduction deserves to be mentioned because of its frequency of application. Two things may possess one common part while completely differing in other parts: for example, two words that rhyme, or a photograph and an oil portrait, or either of these and the face of the original. Let us call the parts of one thing

*abcd*, those of another *cdef*. It easily happens that by mediation of the common parts, *cd*, the train of thought is carried from *ab* to *ef*. Thus we may say that our train of thought is determined, not only by simultaneity of previous experience, which is often quite fortuitous, but also by similarity, by essential connection, by relationship.

The possibilities of reproduction are, of course, very numerous in each case of experience. At present I see before me some books of reference, on the hill at a distance a house partly hidden by trees, and many other things. All these have previously been in my mind, each in various temporal or essential connections with other things. An immense number of images might therefore be reproduced now in my mind. That as a matter of fact I do not become conscious of all of them needs no further explanation. It has been spoken of before when we discussed the limitation, the focalness of consciousness, that is, attention. We have also stated some of the rules determining the selection among these many possibilities. Let us here state these rules more definitely.

Whatever tends to bring about strong feeling, also tends to be reproduced. A brilliant success, but also a humiliating defeat, are not easily forgotten. They are always lying in ambush, so to speak, ready for the least opportunity. As in attention, so here even more, pleasant thoughts show this tendency more strongly than unpleasant ones. What is unpleasant is soon repressed. This is illustrated by such facts as the healing power of time, the painting of the future in glowing colors, the unfailing belief that advancing age has in the good old time.

A second law governing reproduction may be called the set of the mind. When a railway train enters a large station, there are many paths over which it might

pass; but its actual path depends on the position which was given to the switches immediately before the train's arrival. In a similar manner the path taken by the mind depends on the set established just a few seconds or minutes before by the contents of the mind. If during a conversation in English a French word is unexpectedly pronounced by some one, the other people, though perfectly familiar with the French language, may fail to understand it. The French sounds are unexpected — the track is there, but the switch is not properly set — and consequently the sounds remain ineffective. A certain book seen on my desk calls up associated ideas very different from those which are produced when I see it in the bookstore. The same thought leads to one conclusion in the dark or in a dream, to another conclusion in daylight or in the waking state. Every student is familiar with the difficulty of becoming conscious of the right kind of ideas after having just gone from one recitation room to another. After a few minutes the new set of the mind is established, and the difficulty has disappeared.

Many other factors are to be mentioned as influencing the train of thought. During the last decades many experimental investigations have been devoted, with much success, to their exact determination. Numerous methods have been used, some being only slight modifications of the conditions under which ideas are reproduced in ordinary life, others being more artificial in order to yield answers to special questions to which the other methods are not applicable. The common involuntary reproduction of ideas by words or pictures shown has been used in order to determine how this reproduction varies with different individuals under different circumstances, how much time it requires, and so on. Voluntary reproduction of impres-

sions that have just been made (as used in school in dictation) has been used by presenting, optically or through speech, words, syllables, numbers, or pictures and telling the subject to write down everything remembered. The quantity of the matter retained, and the number and kind of errors, then permit many important conclusions. Also whole poems or pieces of prose have been memorized, and answers have been found to questions as to the length of time necessary for such memorizing under different conditions, and the number of additional repetitions needed to make the material learned available again after a greater number of days or weeks. The acquisition of the vocabulary of a foreign language or of a set of historical dates has been developed into a special method of hitting or missing. The material to be learned has been presented in pairs, and the number of pairs has been counted of which one element causes the mental reproduction of the other. By all these methods psychologists have definitely secured many rules which had been derived from earlier, less reliable experiences. Many new facts have also been discovered. Let us give a brief account of the results of this work.

That which has been in consciousness most recently is, other conditions being equal, reproduced most readily. For some time the memorized material is reproduced so easily that it seems to have found a permanent place in our mind. Soon, however, it begins to be forgotten. At first this forgetting goes on with great rapidity; but it becomes slower and slower, so that a person retains very little less after thirteen months than after twelve. Even after twenty years definite traces of a single former memorizing have been proved to exist. Nothing, therefore, is likely to be completely lost, although voluntary reproduction has long since become impossible.

The most important factor contributing toward certainty of reproduction is frequent repetition, of course with attention, for without attention no memorizing is possible. The experimental investigation of the influence of repetition has yielded, among minor ones, two particularly interesting results. One of them justifies an educational practice which had already been adopted by teachers because it seemed to be advisable. In order to memorize any material we should not try to force the desired end by accumulated repetition without pause. It is much more economical to devote a short time to learning, long enough for a few repetitions, to do this again after a pause of some hours or days and again after the same interval, until the desired effect is obtained. The total time required for obtaining this effect would be much greater if the total process of memorizing were to occur at one time without intermission.

Another result of experimental investigation is contrary to the tradition of educational practice. It has been proved that, in order to learn a long poem, monologue, or piece of prose, this should not be divided into smaller parts. It is uneconomical to learn each stanza or sentence separately. The whole should always be read from the beginning to the end, without introducing points of division which are not desired at the time of reproduction.

The method of involuntary reproduction has recently been applied to a problem of much practical significance. The attempt has been made to reveal thus associations of ideas which have been firmly established, but which the subject has strong reasons for keeping secret, for instance, the ideas forming the memory of a crime which he has committed. He is asked to tell or write as quickly as possible a word suggested by each of a great number of words

presented to him in succession. Among these latter words are given some which have a special relation to the knowledge which the subject is suspected of possessing. If the suspicion is correct, it is likely to be shown in either of two ways in the answers to these test words. Either the expected (for instance incriminating) answers are actually given and reveal thus the subject's knowledge; or if these answers are inhibited and voluntarily replaced by others of a more innocent appearance, the time of answering, the reaction time, is considerably increased. It may also happen that the subject, under these conditions, becomes confused and gives absolutely meaningless answers.

That the individual differences in the ability to memorize are very great, has always been observed. Modern psychology, however, has added to this knowledge an insight into the various kinds of differences and their proper causes. Let us notice the perception and imagery types. There are people who perceive and imagine very readily visual sensation groups. They give attention to the shape and color of the things rather than to any other sensible qualities, and they imagine visual shape or color very vividly so that the right and left, the above and below, of their imagery is clearly in their minds. In others auditory perception and auditory imagery are very vivid; in a third class of persons the same is to be said of kinesthetic mental states. We therefore distinguish visual, auditory, and kinesthetic types of consciousness. There may be also gustatory, olfactory, and other types, but they are of little practical importance. Extreme cases, where one of these classes of mental states is extraordinarily developed at the expense of all others, are rare. Eminent ability in art or music probably depends on such development. Generally, one kind of imagery is but slightly superior to the rest.



There seem to be further individual differences with respect to a predominance of either word images or images of the things of nature. All these differences bring about numerous variations of memory. The visual type is able to play chess blindfolded, to repeat a memorized series of numbers somewhat slowly also backwards. To the auditory type these performances seem miraculous. But the former in recalling easily confuses similar looking elements of such a memorized series, which the latter would certainly distinguish because of their difference in sound. The auditory type, however, confuses elements that are similar in sound or accent. The auditory and kinesthetic types depend largely on reading aloud for memorizing, while the visual type is scarcely aided by it. These differences are of much importance for all the various kinds of professional activity.

### QUESTIONS

95. In what respect is memory the opposite of attention?
96. In what respect is reproduction by similarity superior to reproduction by simultaneity of previous experience?
97. Can you illustrate the relations between feeling and memory?
98. What is meant by the set of the mind?
99. Illustrate the dependence of memory on recency.
100. Illustrate the two laws of repetition.
101. What method has been devised for the diagnosis of memory which is not voluntarily revealed?
102. What is meant by perception or imagery types?
103. Can you illustrate the practical importance of the types of consciousness?

### § 10. PRACTICE

The word *practice* refers to a number of different phenomena having this in common, that they occur when the same mental function is frequently repeated, either in im-

mediate succession or with moderately long intermissions. To a large extent practice is identical with the selective and supplementing functions of the mind which are discussed above. But certain effects included in the term *practice* cannot be understood thus and must be regarded as the signs of a more fundamental law of the mind. Setting aside, however, the distinction between fundamental and secondary regularities of mental function, two facts should be mentioned here.

The more frequently the same task is imposed upon our mind, the more perfectly — this is the first fact — is it carried out. But perfection has various aspects. So far as sense perception is concerned, perfection means a lowering of the so-called threshold of perception and of discrimination, especially the latter. Weaker sounds, lights, tastes are perceived; smaller differences of color, tone, weight, movement, size are correctly named. Perfection means also greater quickness of response. The same number of elements is perceived in less time, is memorized or reproduced more quickly. The rapidity of reading, thinking, writing, and other skillful movements is increased. Perfection means, further, an enlargement of the scope of the situation responded to. We are conscious of a greater number of its parts after having perceived a certain thing repeatedly. Of different things a greater number are simultaneously perceived. After repeated performance of a certain act, we take into account a greater number of circumstances and adapt it to them. That a certain activity which has been engaged in repeatedly can be continued longer at one time, may also be mentioned in this connection. So far as definite purposes are concerned, these are accomplished more and more economically and accurately, that is, with less ex-

penditure of energy, with stricter avoidance of unnecessary movements, with a decreasing number of errors.

A second phenomenon of practice is the simplification of the conscious processes preceding purposive action. Unless there are particular causes, as anticipatory ideas or an extraordinary special interest, that which has often occurred tends to remain unconscious, so that the response may be called automatic. The ticking of a clock, the noise of a street, the laughing of a mountain stream, soon cease to be attended to, although attention to them is always possible. Reading, writing, arithmetical work, when being learned, include a vast number of states of consciousness which no longer occur when these activities are performed by a grown person. After thousand-fold repetition great rapidity of execution results from the omission of a multitude of mental states without which the performance could not originally have been brought about. But the original effects of those lost mental states are not at all lost. The same movements are carried out with the same accuracy as if they were governed by those mental states. Each single letter, even each word, is not found in the consciousness of a person who reads rapidly, and yet he pronounces the word correctly. Each single note or printed chord is not in the consciousness of the pianist, and yet he plays the chord correctly. The same holds for all complex movements that are slowly learned and often repeated, as knitting, sewing, swimming, horseback riding, dancing, skating. They finally require a minimum of mental energy. They become comparable in this respect to the native, instinctive movements; but in order to distinguish them from the native movements independent of consciousness, we call them automatic movements.

Practice, therefore, is a general term referring to the

wonderful adaptation of mind to the external world for the purpose of self-preservation. By association and reproduction mind adapts itself to frequently recurring events and anticipates them. By practice it adapts itself to those events which recur with particular frequency and which are of particular importance. These events are through practice comprehended more delicately, more quickly, and more inclusively. They are responded to in a manner tested as the most fitting and most prompt, and yet requiring only a minimum of mental energy, of which more than a limited amount is at no time available. Without having to neglect the ordinary and as such important, mind has energy left to devote to that which is new, unusual, surprising.

### QUESTIONS

104. What are the effects of practice on sense perception?
105. Illustrate how practice simplifies thought.

### § 11. FATIGUE

The conditions of fatigue are similar to those of practice. Fatigue occurs when mental functions are repeated too many times in immediate succession. But the result is not perfection, but deterioration of the performance. The sensitivity for weak stimuli or small differences of stimuli disappears. Attention is decreased, that is, fewer mental states are vivid, and they are also less vivid. New ideas do not easily enter consciousness. Reproduction, as in the processes of reading and arithmetic, is slow and inaccurate. Action becomes slow and awkward, and may cease altogether.

Fatigue is obviously a protective measure. When the continued performance of a task threatens to exhaust the organs, their resistance to the call for action increases,

and finally they completely refuse to respond. Because of the continuity of all organic processes, this refusal in extreme cases is impossible without a lesser degree of refusal before the extreme is reached. The first indications of fatigue thus appear soon after a prolonged mental activity has begun, as a diminution of the effects of practice. This leads often to the astonishing consequence that a certain performance is executed better at the beginning of a practice period than at the end of the preceding period. The acquired practice is then still effective, while the effect of fatigue is absent. This experience does not justify the conclusion that skill has increased during the time of intermission.

Because of the great importance of fatigue for mental and bodily health, numerous investigators have in recent years undertaken to study it more closely by experimental methods. Especially fatigue caused by school work has been much under discussion in scientific and popular periodicals and even in the daily press. Little progress, however, has been made in our knowledge of fatigue. It has proved difficult to find reliable methods of measuring it, and the great complexity of the conditions has interfered with the interpretation of the experimental results. The attempt has been made to measure mental fatigue indirectly by measuring the muscular fatigue caused by repeatedly lifting a weight; or by measuring the minimum distance of two touches on the skin recognizable as two. Although there are probably relations of cutaneous sensitivity and of muscular fatigue to mental fatigue, they are not definitely known, and by some their very existence is doubted. Other tests used for the measurement of fatigue are adding numbers of several digits, adding a long series of digits, and taking dictation. In these tests the mental

work is very one-sided and too simple to permit conclusions with regard to fatigue under ordinary conditions of mental activity. A disturbing element in these tests is the rapid perfection of the work under the influence of practice. If we choose more complicated tasks such as translation into another language, mathematical problems, or filling in words which have been omitted from a certain text, we cannot easily make two tasks sufficiently alike to be able to compare the results obtained from them.

But none of these methods solve the chief problem, namely, the determination of the point at which fatigue begins to be permanently harmful. There is no doubt that in moderate degrees fatigue is a perfectly normal phenomenon, involving no detriment to our future efficiency. Otherwise most people would be wrecked before they are fully grown. The experience of athletes and soldiers shows that even rather high degrees of fatigue are compatible with the normal growth of bodily strength. The same may be true for mental life. The assertions of great damage done to children by school work are — so far as normal children are concerned — certainly greatly exaggerated.

### QUESTIONS

106. What are the effects of fatigue?
107. Into what complication does fatigue enter with practice?
108. What attempts have been made at measuring fatigue?
109. What is the chief problem in connection with fatigue?
110. Is the fatigue of school work harmful?

## C. THE EXPRESSIONS OF MENTAL LIFE

§ 12. *sensation* PERCEPTION AND MOVEMENT

The impression upon the mind is not the ultimate end of the nervous processes originating in the sense organs. The end is rather activity of the motor organs of the body, which we may here, accepting the naïve conception of matter and mind, regard as effects or expressions of mind. The complications of the mental life of a grown person tend to make this connection between mind and motor activity often obscure and doubtful. It seems that often we receive impressions quite passively. Nevertheless the connection exists. Every impression made upon the mind by the external world is in some way responded to by movement. The movement may occur in the stimulated sense organ itself, in the arms, the hands, the fingers, the legs, the feet, the head, the vocal organs, also in the internal organs, the heart, the blood vessels, the alimentary canal, the lungs. The significance of many of these movements is but insufficiently understood, for example, laughing, weeping, blushing, trembling. But those movements which directly affect the organism's surroundings are easily understood. They may be classed under two headings, self-preservation and play. Another way of classifying them is to distinguish movement toward the object perceived and movement away from the object, without taking these terms in too literal a sense.

Innumerable illustrations for these classes of movements suggest themselves. A piece of bread put on the back of the tongue is moved down the esophagus by the proper muscular contractions. A particle moving into the wrong passage is thrown out again by coughing. If the palm of

an infant is gently stroked, the hand closes and takes hold of the stroking finger. If the palm is scratched, the hand quickly recedes. A mild and steady light attracts the child's eye, which follows the movements of the light. From an intense and flickering light the eye turns away. A piece of sugar is kept in the child's mouth and moved about by the tongue until it is dissolved. A bitter root causes the lips to recede and the tongue to make a pushing movement. If the child is hungry, he cries, kicks, and strikes out with his arms until he is fed. After being fed he lies still so that digestion is not interfered with by the blood being drawn into the peripheral parts of the body.

Movements which do not serve self-preservation so directly are called play. When a cat perceives a mouse, she jumps at it and catches it. But before eating it, she usually lets it loose and catches it again, and so on several times. When she finds a ball of yarn, she treats it similarly, although she must know that it is not edible. A dog gnaws a bone because this contributes to his nutrition. But he also gnaws table legs and rugs, although these have no nutritive value. He chases rabbits and other small animals which he can eat. But he chases no less eagerly other dogs, wagons, cyclists, horses, none of which serve as articles of food for him. The same is true for man. The infant's kicking, the small child's breaking of his toys, do not have any immediate value. Men and animals respond to things not only by fighting, but also by play. The significance of playful movements is to be found in the exercise, the development, and the conservation of the abilities given to them by nature. As in the movements of self-preservation, so in play pleasantness and unpleasantness make their appearance. Extensive exercise of nat-



ural abilities is highly pleasant, enforced inactivity equally unpleasant.

But play is more than a general exercise of the bodily organs. It is a preparation for the specialized activities of the serious part of life. The animal meets in play things which behave very much like those things which it has to obtain for food. So it learns to obtain food at a time when food is not yet needed. It learns to defend itself when no one yet attacks it. The biological significance of the play movements obviously consists in this preparation for the special activities of life. Those animals which do not possess a strong tendency to play are thus at a disadvantage in the struggle for life, because they miss the opportunity for preparation. Serious activity and play accompany man and animal all through life; but the proportion changes. The young are taken care of by their parents, and play may therefore prevail. With maturity this changes, and less time is left for play.

All these movements of self-preservation and of play are natural inherited responses of the organism to its environment. Many of them do not appear at the very entrance into life, but at different stages of age and growth. They are the raw material from which all conduct is derived and built up. Their nervous conditions are the nervous processes in the reflex arches of the subcortical nerve centers. From the points of sensory stimulation, the nervous processes are carried into definite muscle groups so that definite movements occur. These movements are called *reflexes* or *instincts* according as they are rather simple or more complex. Both reflexes and instincts are inherited movements following in direct response upon sensory stimulation.

## QUESTIONS

- 111. What is the ultimate end of every nervous process?
- 112. What are typical movements of self-preservation?
- 113. What are typical movements of play?
- 114. Is play more than a general exercise of the body?
- 115. Are all inherited movements possible immediately after birth?
- 116. What is the difference between reflexes and instincts?

## § 13. THOUGHT AND MOVEMENT

Consciousness is not a factor in reflex or instinctive movements. But these movements soon enter into a two-fold connection with consciousness. (1) When such movements occur, they often result in consciousness. They are either seen, or perceived through the sense of touch or through the kinesthetic sense. These images of the movement become associated with the images originating from the sensory stimulations which give rise to the movement. (2) In consequence of this association the visual, touch, and kinesthetic images of the movement, particularly the most common, the kinesthetic, may themselves produce this movement to which they owe their existence. The mere thought of how one feels when performing a movement brings about, if it is vivid enough, the movement itself. The hearing of dance music awakens the kinesthetic ideas of dancing, and these become real movements, although perhaps only swaying movements of the body or the head. Vivid thinking similarly brings about whispering of words. Even vivid imagination of the movement of a foreign body has such powers. A passionate and excited billiard player thinks of the hoped-for movement of the running ball. This leads to imagery of a similar movement of his own body, and the result is the actual move-

ment, rather ridiculous to the onlooker because it is entirely purposeless.

Through this connection with consciousness instinctive movements become voluntary movements. The term *voluntary* means just this connection with consciousness; it has no other meaning.

Suppose a child sees something white and glittering and puts it instinctively into his mouth. It happens to be a lump of sugar. Its taste is pleasant. It is retained, dissolved, and swallowed. All the impressions, occurring at about the same time, become associated: the sight of the thing, the movements of the arm and hand, the taste, the movements of the tongue and the lips. The more frequently this thing happens, the more firmly established are the associations. Later the sight of sugar reproduces at once its taste, the visual and kinesthetic images of the movements, and the movements themselves — the arm is stretched out, the tongue and lips making sucking movements — although the sugar may be lying so far away that it cannot be touched. The child's consciousness then contains what we have previously called will, and what may also be called desire: a vivid impression accompanied by pleasantness, sensations of restlessness, and an image of a pleasant conclusion of the whole experience. We say then that the child wills, desires, to have the sugar.

We can will to do only that which in its elements we have previously done by instinct. If we do not know how a movement feels when we perform it, of course we cannot bring it about by way of our consciousness, that is, by our will. Children have as much command of speech as they have acquired by instinctively producing speech sounds in response to accidental stimulations. This instinctive production occurs usually rather late in the case of certain

sounds, as *k*, *r*, *sh*; and accordingly, in spite of all special efforts on the part of the parents, children learn to produce those sounds only at that late time. We presuppose, of course, that they are not deaf. For in deaf children the speech sounds instinctively produced do not enter into an association with the kinesthetic sensations and therefore cannot be voluntarily reproduced; that is, the children remain dumb. Many a grown person remembers that all his attempts at learning the pronunciation of a certain sound in foreign speech (take for example the guttural German *r*, or the German *ch*, or the French nasal sounds) were in vain until by a mere accident, instinctively, he pronounced that very sound. After that he had command of it.

This interweaving of the instinctive reactions of the body with conscious life is of the greatest practical significance. However well adapted the inherited reflexes may be to the purpose of keeping the young animal alive, they are very insufficient in meeting the ever growing complications of life. And they are not perfect even in the beginning. A reflex is the response to a present and direct impression upon the organism; but very similar impressions may come from things of different properties. Poisonous substances often look and taste like articles of food. The enemy assumes the attitude of a friend welcoming you. Reflex action is powerless to give the organism the protection needed in such cases. Instinct is easily deceived. But as soon as the harmful consequences impress themselves upon the organism, the instinct is modified, and in the future these consequences will be avoided. The instincts are ready-made institutions intended to be applied to average conditions. Their readiness and completeness is in so far of inestimable advantage to the organism. If it had to learn everything necessary for life, it could not sur-

vive. But for the manifold deviations of the external world from the average no provision can be made in this manner.

The variation of the organism's response is made possible by the existence of higher nerve centers, that is, of connecting neurons of a higher order, more remote from the sensory and motor points of the body. Let us imagine the proverbial reaction of a child to the sight of a flame, and discuss the successive stages of development by the help of figure 15. (1) The visual stimulation starts a nervous process from  $s_1$ , which passes through the bulb and spinal cord into the muscles of the arm at  $m_1$ . A small part of the current may branch off at  $a$  and, instead of passing down towards  $b$ , take the direction of  $v$ . But the resistance in this direction is for the present so high that only an insignificant part of the process can take this way, and so no corresponding motor response is noticeable.

(2) While all this is still going on and the child's arm is still moving forward, the heat of the flame acts as a pain stimulus at  $s_2$ . The nervous process produced passes over  $c$  and  $d$  to the muscles at  $m_2$ , whose contraction results in the arm's being pulled back. This results in a third stimulation at  $s_3$ , which we need not trace farther here. But not the whole of the nervous process passes from  $c$  down to  $d$ . A part of it, of considerable absolute magnitude because of the intensity of stimulation, passes from  $c$  up

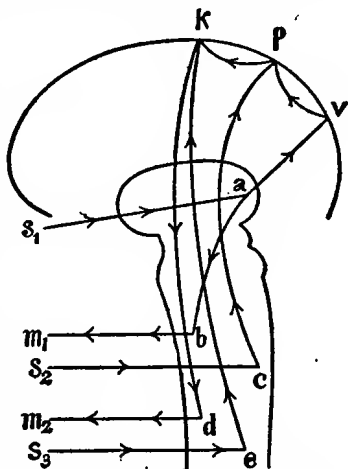


FIG. 15.—"A BURNT CHILD FEARS THE FIRE."

to  $p$  and thence over  $k$  down to  $d$  and finally also into  $m_2$ . This process going from  $p$  to  $k$ , according to a general law of nervous activity, tends to attract other, weaker nervous processes, if the neuron connections make this possible. Consequently the nervous process from  $s_1$  to  $a$  is now turned mostly into the path  $a-v-p$  and only an insignificant part of it continues to go from  $a$  towards  $b$ . The consequence is that the resistance of the path  $a-v-p-k-d$  is soon reduced to less than the resistance of the path  $a-b$ . The great significance of this fact becomes clear in the third stage of development.

(3) At some later time the flame again acts as a visual stimulus. But now, because of the change of resistance just explained, the nervous process takes for the most part the path over  $a-v-p-k-d$ , and the reaction follows at  $m_2$  instead of at  $m_1$ . The child has learned to avoid the flame. The child, when seeing the flame, is conscious of the pain, as imagery, without having to receive the actual stimulation at  $s_2$ .

Thus the inflexible regularity of reaction gives place to another type of reaction, an adaptation, not only to those conditions which at the time make their impression upon the organism, but also to those conditions which are mere future possibilities. The experience of the past guides the organism into the future.

## QUESTIONS

117. What is the twofold connection into which instinctive movement enters with consciousness?

118. Why is the movement of a billiard ball often accompanied by movements of the players or spectators?

119. What is a voluntary movement?

120. In what manner is will dependent on instinct?

121. Why do deaf children not acquire speech? Can they be taught to speak?

122. Why is the acquisition of foreign speech sounds by grown people often so slow?

123. What is the advantage to the organism of voluntary over instinctive action?

124. Can you describe the three stages of nervous development illustrating the proverb "A burnt child fears the fire"?

## CHAPTER III

### COMPLICATIONS OF MENTAL LIFE

#### A. THE INTELLECT

#### § 14. PERCEPTION

##### 1. *Characteristics of Perception*

AT every moment of waking life a multitude of impressions are received by the mind through the eyes, the ears, the cutaneous and all other senses, giving information about processes in the external world and in the subject's own body. However, because of the peculiar laws of mental activity, the actual conscious experience differs greatly from a mere sum of all those impressions—from what would be the content of consciousness if mind were nothing but an accumulation of senses. In order to distinguish the actual consciousness from the abstractly conceived sum of sensations, we use as a specific term the word *perception*.

Does not a newspaper look different if held in the right way or turned upside down, a landscape if seen in the ordinary way or through our legs? In the latter case there are in our consciousness a multitude of incomprehensible details, lines, figures, colors; in the former we are conscious of one thing, a landscape, with its divisions, each of these divisions with its subdivisions, and so on. The one consciousness is practically the result only of simultaneous



sensory stimulations; the other consciousness, in addition to these stimulations, is determined by the laws of organized mind, by attention, memory, practice.

A percept contains both less and more than the sensations corresponding directly to the stimulations. According to the conditions discussed under attention, certain sensations become focal at the expense of others which become marginal. For example, of all things impressing themselves upon my retina, only a few — usually, but not always, those in the center of the field of vision — attain a high degree of consciousness. And of these things again not all the qualities, but only a few become highly conscious. If, as in this case, the visible things happen to become highly conscious, the simultaneously existing audible or tastable things are apt to remain at a low degree of consciousness. That which is important for the needs of our daily life is specially favored and becomes a part of the percept. That which has no practical importance does not easily become a highly conscious part of the present mind. The variations in color of a gown forming many folds are rarely noticed. All parts of the gown are perceived as parts of the same substance. That the whole gown is made of one kind of cloth is practically important. That the various folds appear to the eye — because of the variation of the illumination — somewhat different, is of no practical consequence. Many quite common phenomena, after-images, overtones, difference tones, are never known by the majority of people, because of their practical unimportance.

But a percept contains not only less, but also much more than the sensations corresponding to the stimuli of the moment. Numerous images are woven into this system of sensations and thus give additional meaning to it. We

may be said to *see* that the things are hot or cold, rough or smooth, heavy or light, although our eyes as mere sense organs cannot give us any such information. In the same way we may be said to see that the things are at this or that distance from our head, and that this thing is nearer, that thing farther from us, although our inherited ability to see things spatially does not give us any other information than that of shape and size in the field of vision. By incessantly repeated experiences we have learned, at an early age, that changes in the distance of things which in this or that way have come to our knowledge, are regularly accompanied by definite changes in their size, their coloring, their appearance when the right eye's image is compared with the left eye's image, and many similar changes of the impression. Whenever such signs of changes in the distance are impressed upon our mind, we immediately supplement them by ideas of the distances themselves. Thus our original two-dimensional perception of space is expanded into a three-dimensional perception.

All knowledge of things, of their properties, their names, their uses, their meanings, consists in supplementing our consciousness of those qualities which they present to our senses, by images previously obtained through any senses. The force of this supplementing can be understood from the drawings of children and primitive peoples. That which appears in the field of vision is often left unrepresented. Linear perspective, for instance, does not exist in such drawings, although it is a part of the sensory impression. On the other hand, many things are given by the draughtsman which are invisible under the circumstances of the situation, but which he regards as essential parts of the thing because of their practical importance: for instance, both eyes of a person seen in profile, equal length

of all the legs of tables and chairs, equal size of things at a distance and things near by.

The significance of this supplementing by ideas is illustrated also in pathological cases. It happens that some of the associative connections in the brain are destroyed by disease, reducing the mind to a condition like that of early childhood, when direct sense impressions alone determined action. Patients may see the shape and color of a thing correctly, may even be able to draw it or paint it, but are unable to tell the name of the object, although they are perfectly familiar with it. They cannot answer our question as to what purpose the thing serves; possibly they give ridiculous answers, fitting an altogether different thing. Only when they are permitted to use the kinesthetic and tactual senses by taking the thing in their hands, do they recognize it. In other cases the patient, although possessing his normal sensibility to touch, is unable to recognize things by his hands alone, but recognizes them at once when permitted to open his eyes.

A particularly characteristic feature of our perception is the grouping together into a mental unit of elements which are not united either spatially by contiguity or nearness, or by similarity of their coloring, or their other attributes. The grouping of such elements into a unitary mental state is often the result of a repeated necessity for reacting upon this sum of impressions by a unitary movement. The newspaper held upside down does not invite the reaction of reading. Parts which are separated by blank spaces or by black bars, are separately perceived. But the words and sentences are not perceived, because we have not previously been obliged to read under such conditions. Looking into a furnished room I perceive at once tables, chairs, and other pieces of furniture, although the legs of a chair, for

example, are spatially and by their coloring better connected with the carpet than with the back of the chair. When I am looking at a portrait standing upside down, the dark hair and the dark background become a mental unit, a percept of a dark area. The light face is another mental unit. In upright position the hair separates from the background and unites with the face. I then perceive a person before a dark background, in spite of the similarity of coloring between some parts of the figure and the background, in spite of the difference of coloring between some parts of the figure and other parts. The grouping of the elements in perception is therefore widely different from that which would result from the stimuli directly. It is determined by our habits of reaction upon such groups as frequently appear together in the world in which we live.



FIG. 16.—TWO POSSIBILITIES  
OF PERCEPTION.

Let us illustrate this by two figures. Figure 16 may be perceived as a rabbit's or as a duck's head. When we perceive the figure as a rabbit's head, the white streaks to the right of the eye are two separate sensation groups, each of them unified with respect to the effect

produced by them in our nervous system. They are then the animal's lips. At the same time the protrusions to the left make us conscious of softness, warmth, flexibility. Now perceive the figure as a duck's head. Immediately those white streaks cease to be two separate units for our mind. Together with the darker parts surrounding them, they affect our mind as a single unit, the variegated back part of the duck's head. And at the same time the protrusions to the left make us conscious of hardness, cold,

rigidity. The sensory stimulations are exactly the same, but they are differently grouped together, and they bring about further nervous activities which greatly differ in these two perceptions.

Figure 17, when shown to a person, is perceived as the result of a child's careless handling of his ink bottle, as an ink spot. But ask this person if he does not see a boy falling downstairs, and immediately certain elements are grouped together and affect us as being the legs, other elements of sensation are perceived as the arms, and so on. And now suggest to the same person to turn the page slightly to the right and see a man trying to put on his shirt. Quickly the perception changes again; but this time not so much by the breaking up of the former units into their sensory elements and the formation of new units, as by a change of the accompanying ideas. The previous suggestion tends to make us perceive these sensations in one or the other way because it guides our attention. But this guidance is possible only because certain groups of sensational elements (for example, the groups illustrated by our figures) have very often occurred in our mind in consequence of the fact that they originate from external



FIG. 17.—VARIETIES OF PERCEPTION.

objects which have often been presented to our sense organs among greatly varying surroundings. Thus we have learned to group these elements together and to neglect, more or less, all other elements which may be presented simultaneously.

The total process of selective grouping and of furnishing the groups formed with additional mental contents has often been called *apperception*. But this meaning of the term *apperception* is not universally adopted. Some mean by *apperception* mainly the selective grouping of the elements, others mean by it exclusively the furnishing with ideational contents. Because of its ambiguity the term *apperception* has been entirely omitted from the present book, and the term *perception* is used in its broadest sense, including both the processes just mentioned. Perception thus means the working over by the mind of any aggregate of sensational elements given at the time through the sense organs.

## 2. *Illusions*

While the laws of perception are, on the whole, of the greatest benefit to the organism surrounded by a confusing multitude of physical elements bound together into a large number of more or less stable compounds, of things, there are exceptional cases in which these same laws lead the mind into a reaction not suitable to the situation presented.

That which has often occurred is likely to recur. But it does not regularly recur in the same manner. There are exceptions. It happens that certain things occur in surroundings different from their usual surroundings. These things are then perceived, that is, grouped together and supplemented by images, in harmony with their usual surroundings. But the perception is then in discord with the actual surroundings. To the inhabitant of the plains the colors of things appear rather saturated, and the outlines sharp, when these things are at a small distance from the observer. Walking toward them, he is soon able to lay

hands on them. But when the air happens to be unusually moist, and because of its diminished weight, free from the particles of dust which have settled because of their weight, things look unusually near, and on walking toward them he discovers that it takes more time to reach them than he expected. The same happens when he goes to the mountains for his vacation, because there the air is always comparatively free from dust. We have here a foreseeing of what ordinarily becomes the subsequent experience, but fails to become it in this instance.

There is another kind of illusion based on the fact that sensations which have been imagined just before the stimuli became effective, are thereby favored and become unusually vivid. This law of attention holds good also when the stimuli are not in exact correspondence with the preceding images. In such a case the perception is more or less assimilated to those images, so that the same stimuli result in somewhat different percepts according to circumstances. "How heavy it is!" said a friend of Davy's, when the discoverer of potassium placed a little piece of this metal on his finger. Potassium is so light that it floats on water, but the metallic appearance produced the image of pressure and changed the sensation into a percept of something heavy. When two pieces of gray paper, equally bright but of slightly different coloring, are put before me side by side, and I ask myself: is not the yellowish paper lighter than the bluish paper, immediately it seems to be lighter. But I begin to doubt and ask myself: is not the yellowish paper darker than the other; and immediately it looks darker.

Let no one say that this is only "imaginary," meaning by this word that there are in my mind both the objectively true impression and an incorrect image of something

similar. Such is not the case. There is no duality of consciousness. There is one unitary experience. Only scientific reflection reveals the fact that this unitary experience has two sources, one in the external stimulation, the other in the central nervous excitation. The result of these sources, the percept, does not betray the doubleness of its origin any more than a stream at its mouth shows the doubleness of its sources. It is a universal property of perception to be determined not by sensory stimulation alone, although this is the primary factor, but also by images, by nervous dispositions. The more vivid such images, the greater is their influence — now and then their *deceptive* influence — on our consciousness of the objectively existing. Suggestion is a name which has recently been accepted for such an influence. Illusion is another name for it, in case it is rather pronounced and ill adapted to the object.

### QUESTIONS

125. What kinds of mental states are called perceptions?

126. Illustrate the change of a percept into a mental state not worthy of the name, caused by a change of the situation which involves neither a subtraction nor an addition of stimuli.

127. What impressions become a part of the percept, and what impressions do not?

128. Show that a percept contains not only less, but also more than the sensations corresponding to the stimuli of the moment.

129. What can we learn about perception from the drawings of children?

130. Illustrate the perception of a thing whose parts appear spatially separate. (None of the illustrations in the text strictly answers this question.)

131. What changes occur when a rabbit's head is perceived as a duck's head?

132. Are illusions signs of mental abnormality? What are they?

133. What two classes of illusions are distinguished in the text?



## § 15. IDEATION

The same laws which govern the supplementing of impressions by images, govern also the supplementing of images by other images. We refer to the appearance of images supplementing other images by the word *remembering*, or *ideation*.

What we remember is always deficient in details compared with what we perceive. Remember a landscape, a street scene, a well-known person. Innumerable details are always lacking in the idea, although they were present in the corresponding percept. These details which are lacking may be either parts separable from the object, or mere attributes of sensation inseparable from the sensation. On the other hand, ideas are richer than percepts. They contain elements obtained from other similar perceptions and added by association, as when the idea of a landscape is enriched by a tower, the idea of a person by a beard, which actually are not present at these places.

Ideas are also strongly influenced and altered by other ideas which happen to be in consciousness at the same time ("set of the mind"); for instance by questions, particularly by questions in the negative form — "did you not," "was this not," — by the wish to make a good impression upon others, and by similar factors. We may have no intention of exaggerating, in Falstaff's fashion, the significance of our deeds; nevertheless our memories become gradually modified so that the uncommon, the important, the valuable in them is emphasized, and the common, the insignificant, the unpleasant is obliterated. Wherever our memories are fragmentary and indefinite, they offer but slight resistance to questions attacking this point, for in-

stance: Do you believe that the gentleman was as tall as you are?

Memories are thus, not exceptionally, but universally inaccurate representations of that which has been perceived. This has recently been proved by direct experimental tests. Since percepts, although they rest on a foundation of external stimulation, are so strongly influenced by the mind's own manner of functioning, the existence of this influence in the case of imagery, lacking such a foundation, is not surprising. Although memories are but rarely totally misleading, mankind has long ago learned to rely upon memory in all important business and legal transactions only when there is agreement between the memories of several witnesses. The changeableness of memory is particularly strong in the child's mind. The perceptual experiences have not been so often repeated as in the adult mind, and the practical importance of accuracy of remembering has not made itself so much felt. For both reasons the child's memory is very unreliable.

The word *imagination* is frequently used to signify a specially strong ability to modify memories by associated images. Thus we speak of the imagination of the child — but also of the artist and the scientist. Without imagination the scientist would not succeed in his task of making the phenomena of nature more comprehensible by showing the consequences of the remotest relations between things. It is clear, however, that imagination is not a fundamental "faculty" of the mind, separable from other "faculties," but a result of the fundamental laws governing mental functions.

Let us turn to the fragmentary nature of reproduced experience and discuss its significance. That previous experience can be reproduced only in fragments is the direct

result of the selective power of attention, which asserts itself in both perception and ideation. Not every quality of a thing presented is equally interesting. A child having a watch takes interest mainly in the ticking and in the glitter of the golden case. Meeting a dog, he gives attention to the terrifying bark and the multiplicity of legs. Suppose now that the dog regularly occurred together with a special impression, perhaps a spoken word; then the recurring of this symbol will tend to reproduce in the child's mind the image of the dog. But the pressure of many competing tendencies does not permit the reproduction of all the qualities of the dog which have become conscious on former meetings with this animal. Only an extract, so to speak, of these qualities is reproduced, and this is made up of those which were formerly especially interesting, — the bark and the legs.

Another factor determining the selection of special qualities of a thing for reproduction is the frequency with which each quality reappears in things which are different in certain respects, but in other respects belong to the same class. The trees of a forest beside which I am walking have many individual differences. But certain features are common to all the trees. These common features reappear again and again, while each of the other features appears only now and then. The same can be said of various dogs met on the street, of various tones of a violin, and so on. If the perception of the trees is experienced together with a certain other percept which may serve as a symbol for the trees, for example the word *tree*, the association of the symbol with those regularly repeated qualities becomes firmly established, whereas the association with the other, more or less varying qualities, remains comparatively feeble. The result is that the symbol

tends to reproduce almost exclusively the former qualities. These come to make up a separate group of images, a general idea.

The laws of attention, practice, and memory, together with the simple uniformity of nature just mentioned, produce thus a peculiar result. They remove ideation from the accidents of external events in an incomparably higher degree than perception. They bring about ideas of the separate qualities of the things perceived, *abstractions*, and ideas of common features, *general ideas*. In many cases an idea is both an abstraction and a general idea. Examples of such ideas to which no equally simple concrete object corresponds, are the idea of a mere length, the color red, sight, a dog in general, a tree in general.

These ideas are of eminent importance for all higher mental development. Mind, in them, departs from that which nature presents, but only in order to take possession of it more securely by systematization and by overcoming the narrow limits of the capacity of consciousness.

By separating the common qualities of things from those which vary we classify the things into kinds and species, we think of them as being in various ways related. Instead of having an incomprehensible mass of things standing side by side, we have a system of coördinated and subordinated things, of groups formed according to closer or remoter relationship; and thus it becomes a comparatively easy matter to survey the multitude of things of which nature consists. Not only order, but law too is thus brought into the phenomena of nature. If we collect sticks of wood and set fire to the pile, we notice that some of them burn lustily, others smolder and smoke, still others do not burn at all. Why so? Repetition of similar experiences is necessary before we can give an answer; but mere repetition of the

same event does not enable us to give the answer. The event must be broken up and general ideas must be formed out of the elements of the event. Then only can we answer the question. Some of the sticks burn because they are dry. Others do not burn so well or do not burn at all because they are wet. Neither shape nor color nor origin nor many other qualities of the sticks have any causal connection with the difference of burning and not burning. Both order and law in nature are recognized by abstraction.

Equally important is the overcoming of the narrowness of consciousness by abstraction and generalization. When I am thinking of trees, the contents of my mind are very few. There may be a word image, a visual image of something tall and branching; hardly more. All the special features of trees of all kinds are absent from consciousness. So I can easily think of additional things, for instance of the age which trees may reach, or the elevation at which trees cease to grow. But the moment I begin by accident to think of a thing which does not harmonize with those features of the tree which thus far have been absent from consciousness, immediately those features become conscious and inhibit the contradictory thoughts. They have been unconscious and yet we cannot say that they have been sheer nothing. The consciousness of the general idea has in some way prepared the path for the special features from which it has been abstracted. They have been carried close to the door of consciousness, so to speak, and the slightest impulse coming from an associated idea will cause them to enter. This is our meaning when we say that within the general idea of which we are conscious all those special features are included. They are included by representation, the general idea being the deputy taking care of their interests. Thus our mind is

freed from the necessity of carrying at any moment a heavy load of actual states of consciousness and is nevertheless able to act as reasonably as if those mental states were present. In using representative ideas, our mind has actually at its service the enormous number of all those individual ideas which are represented by them.

## QUESTIONS

134. Enumerate in what different respects ideation is (more or less) similar to perception.
135. Why are reproduced experiences fragmentary?
136. How does a general idea originate?
137. What is the difference between abstractions and general ideas?
138. Can an idea be both an abstraction and a general idea?
139. Illustrate the formation of a natural law by means of abstraction and generalization.
140. With what feature of political life may the service of a general idea in mental life be compared?

## § 16. LANGUAGE

### 1. *Word Imagery*

There can be no doubt that animals are to some extent able to generalize. A dog or a cat is trained to distinguish between indoors and outdoors and to adjust its behavior accordingly. This would be impossible if the dog possessed no general notion of room or street.

But these generalizations remain rather insignificant so long as they are not connected with one definite image which stands as a symbol for the whole class of things. Nature scarcely presents to us any images which could be used as symbols of this kind. What are we invariably

conscious of when thinking of books, or of trees, or of houses — something that is not only invariable, but also readily separable in our imagination? It is difficult to name anything which fulfills these conditions. But man created what he did not find in nature, symbols which can be used as meaning whole classes of objects and relations of objects. The totality of these symbols is human language.

These symbols are normally divided into four classes of imagery, four languages, so to speak, in such a manner that each class of objects has a symbol in each of the four languages. The first of these languages acquired by the child is the auditory language, made up of the sounds of the words spoken by others. Soon after having begun to understand spoken words, the child begins to speak himself. Thus he acquires a second language, made up of kinesthetic imagery of his vocal organs. These languages are the only ones possessed by illiterates. In school the child learns to read, that is, he acquires a third class of symbols, consisting of visual images of written and printed words. One might of course speak of these as two visual languages, since the sight of written words differs somewhat from the sight of printed words. Finally the child learns to write, and thus acquires a fourth language, made up of kinesthetic images of the writing hand.

These are, of course, not the only languages possible. The blind-born, unable to acquire visual imagery, substitute tactual word imagery by learning to read raised letters or the raised point script generally taught in institutions for the blind. But a seeing person, too, may acquire this tactual language in addition to the other four. The deaf-born acquire a visual language made up of the images of the hand and the fingers representing symbolically letters and words. But it is hardly worth while to enumerate all these minor

languages. The most important ones practically are these four: the auditory, the visual (written and printed), the kinesthetic of the vocal organs, and the kinesthetic of the writing hand.

We saw that the origin of all these languages, that is, classes of word images, is to be found in speech. How speech itself originated in the human race is a problem which thus far is not solved, or at least, of which no proposed solution has thus far been universally accepted. Some light is shed upon it by the answer to the simpler question as to the origin of speech in childhood. Only during the last few decades has this question been given attention, obviously because this growth of speech, as an everyday occurrence, seemed to ask for no explanation. The child imitates!—what else should be said about it? But in order to imitate, the child must first be able to produce the elements of the things to be imitated. And by imitation speech only is acquired, but not the full significance of language.

## *2. The Acquisition of Speech*

(1) Speech originates from instinctive activities of the vocal organs. As a child, when left to himself and feeling well, plays with his hands and kicks, he also, in response to all kinds of external and internal stimulations, moves instinctively (that is, because of his inherited nervous connections) lips and tongue, larynx and chest, and produces a great number of different sounds and sound combinations—not only those which are used in the language of his people, but also the strangest crowing and smacking and clucking sounds. He cannot produce speech sounds without immediately hearing them. Thus an association is



formed between sound perception, kinesthetic perception, and motor activity ; and soon the sound of his own voice stimulates the child to further production of these speech sounds. This explains why the same sounds are often so many times repeated in an infant's babble, and why baby talk contains so many reduplications like papa, mama, byby, and so on.

(2) The sounds invented by the child are used by the parents and other people in their communications with the child. They select from the large number those which are like speech sounds of their own language. They address the child with these words again and again, forming also brief sentences, and thus stimulate the child to produce at will the words which he has at his command, in these combinations and sentences. The child thus becomes more and more skillful in the production of these words. Meanwhile the numerous other baby words which have no significance for the people surrounding him, are gradually lost from the child's mind, so that later they can no longer be produced voluntarily. Practically every child can, on the basis of his articulating instinct, learn any language spoken anywhere on earth. But in later years, when this instinct has weakened and has been replaced by the habit of producing the sounds of a particular language, it is a difficult matter to learn to speak a new language. The sound perception as well as the sound production is then assimilated to the "native" speech, and the words of the foreign language are consequently spoken in a manner similar to the words of the native language. This is meant when we say that foreign languages acquired in adult life are, as a rule, spoken with an "accent."

The activity of grown people influences the child's talking in yet another way. The child hears those words

which are selected by the people surrounding him, usually in the presence of the persons and things and events for which the words serve as symbols. Thus new associations are formed. To the kinesthetic and auditory word images is added imagery of the word's meaning. The child comes to experience the words as symbols and to reproduce ideas of the words when the things appear as percepts or images. Only then can we say that the child has really learned to speak, to express his perceptions, his images, and his feeling and willing in speech.

(3) When the child has reached this stage when he begins to comprehend the practical importance of this activity of his vocal organs, he begins to imitate voluntarily, eagerly, the speech of grown people. This imitation is to some extent mechanical, without involving any comprehension of the meaning of the words. The child simply enjoys being able to produce the same words which grown people use. This imitation is in many cases at first very imperfect, because many elementary sounds necessary for these words have not been produced instinctively thus far and therefore cannot be produced voluntarily, the kinesthetic imagery being lacking. But soon even the more difficult sounds are produced accurately. The vocal organs acquire the habit of assuming certain normal positions, from which the special activity of speech in each case of pronunciation proceeds. In a few years the total number of words necessary for a command of the language is acquired. But voluntary imitation is not restricted to mere pronunciation. It is applied also to the modes of uniting words into compounds, phrases, sentences. The result of this application is the creation of new compounds out of the words which the child has at his command at the time,

of new methods of applying inflection, to the amusement of those who surround him. The following are a few examples of such creations: *goed* for *went*, *chair* for *sitting*, *more pencil* for *I want the other pencil*, *muissing* down as the antonym of *muissing up*.

Voluntary imitation, therefore, does not altogether mean assimilation to the language which the child hears spoken; to some extent it means departure from that language, resulting from the mental capacities with which he has been endowed by nature. In another way too the child's language must differ from that of grown people. All acquisition of speech is based on perception and is subject to the laws of perception. We have previously seen that perception is largely dependent on the interest of the person who perceives, on his previous experiences.

A child's interests are totally different from those of a grown person, so that many words cannot assume in the child's mind the meaning which they possess in the adult's mind. At a later stage this difficulty can to some extent be overcome by the aid of language itself, by explaining in words the meaning of a new word. At the beginning this is of course impossible. So a large number of words used by adults remain for a long time entirely meaningless to the child, especially abstract words, relative words (*to-day*, *here*, *I*), and words meaning things with which the child does not come in contact. Even those which he seems to understand perfectly have a different meaning. A watch is to the child something which ticks and sparkles. The adult's meaning of the word can in no manner be conveyed to the child. The name of a particular article of food may be used for all things which are edible, also for eating, for hunger, and so on. A certain baby called his father, mother, nurse, sister, all by the same name, *dada*, then

applied this word also to his bottle, and finally to every interesting object.

This does not mean that children generalize more than adults, that they have a superior logical capacity. The meaning of the child's words is often more general than that of adults because the child takes interest in fewer qualities, and naturally finds these in a greater number of objects. But the difference is not that of a greater power of generalization. Very often the child's words have a more special meaning. A child is not likely to use the word *animal* as meaning worms, birds, and horses. The difference lies in the fact that the child uses the word as a symbol for a thing or quality which is conspicuous to *him*, interesting to *him*. A child's language is amusing to grown people only because they do not know the meaning which the words have in the child's mind, and are inclined to substitute the meaning which they have in their own minds.

(4) In spite of all imitation, the individual's language is largely his own creation adapted to his individual needs. To the extent to which the children of a community, of a nation, have similar interests and similar experiences, these individual creations must be similar. But to the extent to which interests and experiences differ, language must differ. Baby talk which is quite comprehensible to the members of one family is incomprehensible to those of another family. Similarly, the language of one tribe of the human race has come to differ from that of another tribe, one nation's language from that of another nation. Family differences, of course, cannot last long. The child's language assimilates itself to the language of the people at large as soon as the child comes under the influence of people outside of the family. This is the fourth stage in the de-

velopment of an individual's language, lasting much longer than the three preceding stages, indeed practically never ending. From mistakes in comprehending others, from mistakes of others caused by his own language, or from special instruction in school, the individual learns how the words which he uses are to be understood in order to agree with the general usage of language, and thus approaches more and more the ideal of uniformity of speech.

This uniformity, however, can never become complete. The number of words of which various individuals have command always differs. Their meanings always differ slightly, sometimes considerably. Accordingly the phrases and sentences which one uses differ from those of others. Every one has his own linguistic style. For most practical purposes the actual uniformity of language is sufficient. Not a few misunderstandings, discussions, quarrels, however, have their source in the insufficiency of this uniformity. This is regrettable, but unavoidable. The nature of mind creates language such as it is, and mind has to make the best of it. It is only on a very high level of mental development that men succeed in creating for definite purposes definite languages which admit of almost no differences of meaning; for instance, the symbolic systems of mathematics and chemistry. But these systems prove that the very perfection carries with it an imperfection. The specific power, the art and beauty of language, are not to be sought in mathematical and chemical treatises. They depend on the speaker's and hearer's individuality.

### 3. *The Growth of Language*

Just as one individual's language differs from that of another individual, the language of one time differs from the same nation's language at another time. The words of

a language change or are replaced by new ones. The inflections change, are probably simplified, or as in the case of the English language, almost completely lost. The manner of forming compounds, phrases, and sentences is altered. The meaning of the words is no more fixed; many words change their original meaning entirely, even to the opposite. Changes of the former kind — changes of the sounds, their inflections, and their combinations — are brought about partly by external and fortuitous conditions, such as the Danish invasion of England or the Norman conquest, also by greater ease of pronunciation. But here the laws governing mental life are also determining factors, and in the changes of meaning every growth depends on these laws. The same forces which build up the child's language in conformity with his experiences, thoughts, interests, and needs, bring about also the gradual changes of a nation's language in conformity with the changing experiences, thoughts, and needs.

Under special circumstances one among all the properties or features of a person or thing may occupy the mind almost exclusively, as of Julius Cæsar the despotic power which he obtained, of Captain Boycott the ban which was placed upon him. In such cases, when the name is heard and pronounced, the special feature impresses itself upon the mind. The speaker thinks of little else than this. And when the necessity arises of expressing in a word that peculiarity in another place under different surroundings, the individual name offers itself, since its original meaning has already been modified, since it has already lost most of its individual significance. The part of its meaning which is retained is now generally applied. An expansion of the special meaning has taken place.

On the other hand, words which were originally applied

to many things in many different situations come to signify a particular thing under particular circumstances. This change of meaning is illustrated by the names which the state or nation gives its officers. President, secretary, general, captain, had originally a very broad meaning, but when applied to the officers of the state have a very special meaning. It is easy to explain this. The word *captain*, meaning originally merely the chief of any aggregation of people, is naturally applied by the speaker most frequently to the chief of that company of men in which he is particularly interested. The chief of another company of men is then no longer called by this simple name, but additional names are used. The word when used without additional words comes to mean exclusively the chief of the special group which is of main interest to the speaker. Similarly, *city* assumes for the person living in the country the meaning of the city near by. *Gas* means for the man who is not a physicist only the ordinary illuminating gas.

Other changes of meaning resulting from associative connection and a transference of attention are the metaphors and metonymies. A metaphor is a figure of speech in which one object is spoken of as if it were another; for example, when St. Luke says, "Go ye, and tell that fox," meaning Herod. A metonymy is the exchange of names between things related. *Toilet* meant originally a small cloth, a napkin, spread over a table. Then it came to mean the table itself, used in the process of dressing. Then it meant the process of dressing one's hair, later the general process of dressing one's self. It also assumed the meaning of a person's actual dress, his costume; also the style of dress. More recently it has come to mean the toilet room, the lavatory.

Many changes in the meaning of words result from

certain secondary purposes of the speaker. We usually address another person in order to obtain something from him. In order to succeed, we must keep or make him good humored, give him his proper honors and titles, flatter him rather than call attention to his faults. The consequence of this exaggeration of the person's value is that all titles, all forms of appellation, especially those addressed to the female sex, tend to deteriorate, to lose their original value. *Lady* no longer means the wife of a nobleman, but is applied to a washerwoman. *Sir* is used in a letter addressed to any man, however low his rank.

Deterioration of the meaning of words is not restricted to those used for appellation. Whenever we desire to convey any thought to others, we must make it appear important enough to have people give attention to it. We therefore choose terms which mean more than we intend to say, rather than terms which mean exactly as much or less. We call things lovely or horrid when we mean only agreeable or disagreeable, we speak of heaven or hell when we mean only a good or a bad place. The inevitable result is, of course, that the impressive words become insipid. We call a student fair who is only mediocre, merely because of our good will towards him. *Fair* then comes to mean mediocre, and we call a student fair who is a poor student. Finally, a fair student comes to mean a poor student.

Those who are particularly anxious to use impressive language— young people, students, soldiers— often use the other extreme for the same purpose. They use words which signify low or bad things and relations (slang) in order to refer to the things and relations of ordinary life to which they want to call attention. "Grub" comes to mean human food. "Being plucked" takes the place of "being rejected at an honor examination." *Puritan* and



*quaker* are slang terms of the seventeenth century which have entirely lost their original meaning of contempt and ridicule. In the same way words of low meaning are all the time being raised into the realm of good language.

Speech depends as much on the totality of mental life as perception. A person's choice of words, their forms and their connections, are determined by previous habits of using words, by experience concerning those qualities of things which are most important to his own interests, by his consciousness of his present needs and ends. The general purpose of communication between the members of society tends to obliterate differences between individuals and between generations. But it never does this perfectly. Individuality, circumstances, and special purpose give to the language of each person an individual stamp; and the succession of individuals, of historical conditions, of the varying needs of successive generations, brings about unavoidably alterations in the language. These alterations are retarded by the existence of a written language, of literature. They may also be retarded artificially by training and compelling the members of a community to use the same words and the same rules of grammar and syntax. Such artificial remedies, however, are not without serious disadvantages. They take the life out of language. Force, beauty, and particularly truthfulness in representation of thoughts are likely to be sacrificed unless we are willing to admit a certain amount of lawlessness, which, after all, is the outcome of the fundamental laws of the mind.

#### 4. *The Significance of Language*

Aside from its social significance as the almost exclusive means of communication among the members of society, language has its significance for purely individual mental

activity and mental growth. This has already been referred to above. Language makes possible an almost unlimited refinement of abstract thought, a complete analysis of the data of perceptual, ideational, and affective life into their elements, and the construction out of them of new concepts, first according to their similarities, then according to purposes. Such concepts as acceleration, pitch of tone, irrational number, atomic heat, justice, bliss, would be impossible without language. To the invention of such abstract concepts mankind owes its subjugation of nature. It is difficult to think of the exact manner in which bodies fall when they are dropped; some fall slowly, others with great velocity, some do not fall at all, but rise. But think of them as being in space from which the air has been exhausted, and apply the concept of acceleration. At once the matter is very simple, and it includes even the heavenly bodies with which we never come in direct contact: all bodies fall with *constant acceleration*.

This is but one of innumerable instances. Practically all laws of physics, chemistry, philology, psychology, and all the other sciences are stated in terms of highly abstract concepts. Imagine, for example, the sine or tangent of an angle, electromotor force, molecular weight, consonants and vowels, intensity of sensation. None of these abstract concepts and none of the laws in which they appear could have been invented without the aid of language. How restricted, further, would be our knowledge without language! How limited the exchange of opinions! Think of such a phrase as "the events of the last thirty years." What a multitude of ideas is suggested by it in the most economical manner! Few of these ideas actually become conscious; but all of them are made ready to serve if their services should be needed.

Language further enables us to overcome, whenever this is necessary, the ambiguity of its own elements (the words) which results from the individual and historical conditions influencing the growth of speech. The meaning of words can be fixed by definition. Such words as *circle*, *energy*, *freedom*, have many different meanings (a circle of friends, the energy of style, the freedom of a city). The physicist defines energy as the capacity for performing mechanical work, excluding any and all other meanings. The philosopher defines freedom as the possession of the power to act in accordance with one's inherent nature, independent of external causes. Because of the association between the defined and the defining words, the latter keep the defined word from being used wrongly, by entering consciousness when the defined word happens to be used in an improper connection. It is true that, in order to insure constancy of meaning, the defining words, too, should be defined again by others, and so on. A perfect definition is therefore an ideal which can be approached, but never reached. In spite of this, the value to human thought and knowledge of clearly defined concepts is immeasurable.

### QUESTIONS

141. Why does generalization play such an insignificant part in the mental life of animals ?
142. What are the four languages of educated normal people ?
143. Which of these languages is acquired first by the child ?
144. How does baby talk originate ?
145. How are the reduplications of baby talk to be explained ?
146. What is the origin of "a foreign accent" in speech ?
147. Why does voluntary imitation of speech sounds by a baby develop at first very slowly ?
148. Illustrate the inventiveness of children in learning to speak.

149. What could make one think that children surpass grown people in the ability to generalize?

150. What are the four stages in the development of an individual's language?

151. What is the advantage or disadvantage of uniformity and individuality in the use of language?

152. Illustrate how a word of individual meaning changes to a general meaning.

153. Illustrate how a word of general meaning changes to an individual meaning.

154. Explain the psychological origin of a metaphor and a metonymy.

155. Illustrate and explain the deterioration of words.

156. Illustrate slang and explain its origin.

157. Is it desirable that the written language should retard the growth of the spoken language? Give reasons for your answer.

158. What significance has language besides serving as a means of communication?

159. What is a definition? Why can a definition never become perfect?

## § 17. JUDGMENT AND REASON

### I. *Coherent Thought*

When I receive a letter from a friend, I perceive its words, I become conscious of their meaning, I remember my relations to him; for instance, the time of our first meeting. But my thought proceeds. I wonder how he is getting along now, whether better or worse than myself, whether he has succeeded in overcoming through his greater energy the obstacles which retarded my progress. This is more than perception, imagination, or abstract consciousness. It is a *coherent process of thinking*. The best way of describing its characteristics is to tell what the opposite of *coherent* thought is.

First, coherent thought is not dreaming. The elements of a dream are of course united by something. But they

are united only like the links of a chain. If the second link were removed, nothing would hold the first and the third together. This chain-like thought is frequent in the insane. The following is an example from Diefendorf's *Psychiatry*:—

“My mother came for me in January. She had on a black bombazine of Aunt Jane's. One shoestring of her own and got another from neighbor Jenkins. She lives in a little white house kitty corner of our'n. Come up with an old green umbrella 'cause it rained. You know it can rain in January when there is a thaw. Snow wasn't more than half an inch deep, hog-killing time, they butchered eight that winter, made their own sausages, cured hams, and tried out their lard. They had a smoke house. [Question: But how about your leaving Hartford?] She got up to Hartford on the half-past eleven train and it was raining like all get out. Dr. Butler was having dinner, codfish, twasn't Friday, he ain't no Catholic, just sat with his back to the door and talked and laughed and talked.”

In other cases, mere similarity of words of different meaning, rhyme, familiar questions, or spatial contiguity of things lead consciousness from one idea to a second, from the second to the third, and so on, without any common tie which would unite all these ideas into one system.

Coherent thought, secondly, is no endless recurring of the same few ideas, as when I am brooding over something, when a song which I have heard occupies my mind and gives me no peace, when the thought of having possibly failed to lock the door properly prevents me from sleeping. This recurring kind of thought, too, is a frequent symptom in cases of mental derangement; for example, as a continuously present desire to kill somebody, or as the permanent idea of one's own sinfulness and worthlessness.

Coherent thought is intermediate between the two extremes just mentioned. It is a train of thought regulated

by the associative connections between all the separate ideas and one central idea which dominates and unifies the whole. The thought of a football game or of the destiny of the United States branches out into innumerable partial thoughts, each one leading to another one. But they are all united by their relation to this game or to this nation. Such a coherent thought need not possess a considerable length. Sometimes, as in unconstrained conversation or in letter writing, it may soon be followed by another coherent thought, this by a third, and so on, and these may be related to each other merely like the links of a chain. Sometimes, however, it lasts for hours, as in lecturing on a definite subject, or in writing or reading a chapter of a book or a whole book.

Coherent thought depends largely on *memory*, on associative connections. But it depends also on those conditions which determine *attention*: unless the thoughts have an affective value, unless they are interesting to the individual in question, they are not likely to enter consciousness. Because of this dependence on the conditions of attention, certain persons are capable of coherent thought in some lines, but not in others. Whenever the purely *associative* function predominates over the conditions of *attention*, or conversely, those abnormalities occur of which we have just spoken, mere chain-like thought, or obsession by a single idea.

Nothing else favors coherent thought so much as the possession of language. The simplicity of a word or phrase and its connection with experiences of unlimited complexity enable the mind to keep within one system of thought in spite of temporary deviations, numerous and winding though they be. Such complicated ideas, inexhaustible to him who tries to describe them, as propriety, honor,

duty, may guide and determine a long-continued train of thoughts and actions. The most important one of all these guiding ideas, crystallizing around a single word, is the idea of self, of I.

## 2. *The Self and the World*

Among the impressions received by a child through his sense organs, some must very early distinguish themselves from the rest. (1) When the child is carried about or creeps about, the majority of his impressions change from moment to moment: instead of a wall with pictures, seen a few seconds ago, he sees windows with curtains; instead of tables and chairs he sees houses, trees, and strange people. Certain impressions, however, hardly change. Whatever else he may see, he almost invariably sees also his hands and some of the lower parts of his body. Whatever may be the position of his body, sensations from his clothing, from the movements of his limbs, from the processes in his digestive and other organs are always present. (2) Another impressive phenomenon is this. The things seen often move, and thus cause alterations in the field of vision. But when these moving things are his own arms and legs, yielding to the pull of their muscles, there is an additional experience, made up of kinesthetic and usually also tactual sensations. Certain experiences are therefore a kind of twofold experience as compared with others which are of one kind only: visual plus kinesthetic-tactual. (3) In still a third way certain experiences distinguish themselves. Whenever the child's hands and feet come in contact with external things, a tactual sensation is added to the visual impression. But when one hand touches the other hand or a foot or another part of the body, even a part which is not seen, a peculiar double

tactual impression is received. That this double tactual sensation is particularly interesting may be concluded from the concentration with which an infant plays with his feet, and the enjoyment which a kitten seems to get from biting its tail.

For various reasons, therefore, the sensations of a child's *own body*, visual, tactual, organic, etc., become experiences of a special class. By various peculiarities they distinguish themselves from all others and become a special, unitary group. But the child's *ideas and feelings*, when compared with his perceptions, also form a peculiar system, often keeping unchanged while the perceptions change because of movements of the objective things or of the body itself. It is quite natural, then, that in opposition to the external world a *dual system* is conceived, made up of the bodily sensations on the one hand and the ideas and feelings of frequently repeated or especially impressive experiences on the other. But in spite of this unison between the complex of bodily sensations and the complex of ideas, forming a personal world as opposed to the external world, there remains an opposition between the constituents of the personal world as between a material and a spiritual half of the whole.

This complex idea of a personal world, of personality, which constantly increases in content, is given a special name, John or Mary, and still later another name, *I*. The unity of the idea of personality, the readiness of its appearance in consciousness in spite of the multitude of its contents, is greatly enhanced by this name. The idea *I* becomes the omnipresent and dominating factor in consciousness. I can see nothing, hear nothing, imagine nothing without, however vaguely, thinking that it is *I* who reads, *I* who answers, *I* who designs. It is altogether impossible



to express such thoughts in language without reference to the *I* or the *mine*. In the ecstasy of the mystic or the mental exaltation of the insane, the idea of *I* may be absent, but never under normal conditions at an age beyond that of infancy. Consciousness in which the idea of *I* is rather pronounced is commonly called self-consciousness.

It is plain enough that thinking of the other half of the world, other than the self, is also facilitated by such names as "the world," "the external world." But the concept of the external world does not easily attain the unity of the concept of self, because the experiences referred to are too changeable in comparison with those referred to by *I*. We speak of the external world chiefly in order to distinguish it from the self, not because of the unity of its conception.

The extraordinary support which the consciousness of self receives from language has had also a certain undesirable consequence. We have mentioned in an earlier chapter the universal desire to imagine the world as being under the power of innumerable demons. The consciousness of the self thus leads naturally to the thought of a demon who inhabits the human body. When a person under ordinary conditions is conscious of the *I*, there is no time for its content to unfold itself to any considerable extent. Usually one small group of ideas enters consciousness, even when I ask myself the question as to what I am: ideas of a certain visual appearance, a certain position in society, a certain age, certain aims in life. It seems then that the concept of self is exceedingly simple. This apparent simplicity gives aid to the idea of the existence of a simple demon, independent of time, eternal, inhabiting and governing this body as long as its organs are held together by their normal physiological functions, after the body's death going elsewhere — whither, we do not

know. But this conclusion as to the existence of a simple, unitary subjective reality is no more justifiable than the statement that, because of the simplicity of the idea *it* in ordinary language, there must be an absolutely simple objective reality which corresponds to it.

Mind may justly be called a unity. But it is not a simple, indescribable unity, a unitary something separable from the sum of the parts of which it consists. It is, rather, a unity comparable to the unity of an animal organism or a plant, which may be well described as consisting of so many different parts functioning together according to definite laws. Within the unity of the mind there are smaller groups which may also be called unities, though in a restricted sense. The *I* is one of these subordinate unities. It, too, is not simple, but consists of parts, sometimes a greater, sometimes a smaller number. It may expand and include almost as much content as mind itself, provided that time is given for such an expansion, and a sufficient stimulus. Usually the *I* is very poor in content, hardly anything else than the word-idea which is the representative of the whole concept.

### 3. Intelligence

It is but natural that thought is largely in harmony with the actual facts. Its contents are derived from sensory experiences, are molded by sensory experiences, and must therefore often be anticipations of sensory experiences. With reference to its agreement or disagreement with the actual facts, we give our thought the name of truth, knowledge—or error. Both truths and errors, like perceptions and illusions, are the results of the laws governing mental functions. But truths are more common in the mental life of certain individuals than in that of others. Youth is

more apt than mature age to give free rein to its imagination, no matter whether it agrees with reality or not. This is partly the result of the mature man's realizing the high value of this agreement and therefore striving for it; partly the unintended consequence of innumerable pleasant and sad experiences, of adaptations which have proved now more, now less successful. But aside from such differences developing during life, there are immense differences of a similar kind resulting from native capacities. We speak of such capacities as reason, judgment, intelligence.

Intelligence does not consist merely in a good memory, making possible the exact reproduction of experiences of long ago. A good memory in this sense contributes much toward a high degree of intelligence, but is not identical with it. Even the feeble-minded are often found to possess an astonishing capacity for retaining dates, poetry, music. But memory adapts the thought processes only to very simple and frequently recurring events. When the circumstances become complicated, it soon proves inadequate.

Imagine a servant sent on an errand. He finds it impossible to execute the instructions received from his master. That ends it, if he is deficient in intelligence. No instructions have been given for this case; thus there is nothing to do but to return home. But the thought of an intelligent servant is more comprehensive. He recalls his master's situation and analogous cases; the probable purpose of the master's order; other possibilities of realizing the same end. Thus he succeeds perhaps in reconstructing the totality of the conditions which led his master to send him, and in meeting these conditions.

Take another example. Of several physicians, all but one are mistaken in the diagnosis of a case. Why do they differ? Every disease is characterized by a multitude of

symptoms. Some of them are obvious, so that no one can fail to notice them: the complaints of the patient. Others are more hidden, but no less important. The physician must search for them. Each symptom, for example, fever, lack of appetite, dizziness, megalomania, may appear in very different diseases. A definite group of symptoms in definite degrees of intensity is characteristic of a particular disease. Two conditions, therefore, must be fulfilled to make a correct diagnosis. The symptoms which are hidden must be called up by those which are obvious, so that the physician can search for them and determine whether they are present or absent; for without first thinking of them he cannot search for them. Secondly, the thought of the present and absent symptoms must reproduce the idea of the disease which is characterized by the presence or absence of just these symptoms. This reproduction is possible only in a mind in which all these ideas are very closely connected, forming a well-organized system. Where this is not the case, the less obvious symptoms cannot influence the decision, and the correctness of the diagnosis becomes a matter of chance.

✓ Lack of intelligence, then, means a *deficiency in the organization of ideas*, a lack of those manifold interconnections by which a large number of ideas may enter into a unitary group—no matter how *effectively* each idea is associated with a small number of others, that is, how excellent the person's *memory*. Intelligence means organization of ideas, manifold interconnection of all those ideas which ought to enter into a unitary group, because of the natural relations of the objective facts represented by them. The discovery of a physical law in a multitude of phenomena apparently unrelated, the interpretation of an historical event of which only a few details are directly

known, are examples of intelligent thought which takes into consideration innumerable experiences neglected by the less intelligent mind. Neither memory alone nor attention alone is the foundation of intelligence, but a union of memory and attention. Energy of concentration must be combined with breadth of interest. It is clear that thought determined by both these conditions is more likely to agree with the enormously complicated events in the external world than thought which is governed mainly by one of them.

How does human intelligence differ from that of animals? That man is immeasurably superior to animals cannot be doubted. But human superiority does not consist in the possession of a higher faculty — let us call it reason — in no way dependent on the lower, animal faculties, to which it is added as a jeweler's tools might be added to a blacksmith's tools. The difference between the animal mind and the human mind is simply this: that the imaginative anticipation of possible experiences of the future is brought about in the human mind by means of more abstract and therefore more comprehensive ideas than in the animal mind. Man's mind is by natural inheritance far more capable of forming abstract ideas than is the mind of the highest animals. Man is further immensely aided in abstract thought by language — his own invention — which furnishes him with symbols taking the place of the most complicated ideas, and because of their simplicity, effecting economy in mental work as tools and machines do in manual labor. Animals, too, possess symbols, cries; but their number is insignificant. The difference between man and animals is therefore only one of degree in properties which are common to both. But these degrees are indeed very far apart in the scale.

## QUESTIONS

- 160. How does coherent thought differ from dreaming?
- 161. How does coherent thought differ from mere recurrent thought?
- 162. What are the conditions on which coherent thought depends?
- 163. What is the significance of language for coherent thought?
- 164. What are the two sources of the idea of self?
- 165. What influence has language on the concept of the unity and indivisibility of self?
- 166. What is the true concept of the unity of mind?
- 167. How does intelligence differ from memory?
- 168. How does the text describe "lack of intelligence"?
- 169. How does human intelligence differ from that of animals?

## § 18. BELIEF

It seems, then, that all our knowledge is a mere adaptation to external circumstances, that truth is entirely relative, being only a fitting relation between the subject and his surroundings. But are there no truths whose evidence is inherent in them? Are there no axioms which are immediately evident? Is it not our task to derive all other truths from these axioms by means of logical rules the correctness of which we are obliged to admit? Or, if there are also secondary truths, which we recognize as such only because they suit our experience, are not those immediately evident truths a superior kind, preëminently worthy of the name? For example, the logical, mathematical, and religious truths?

Our previous discussion of truth and knowledge is indeed insufficient. We called truth any mental state which is in harmony with objective reality, no matter whether this relation of harmony is itself thought of in the truth or not. But we may use the word *truth*, or *knowledge*, in a subjective sense, meaning by it a complex mental state which

*includes the thought of its agreeing* with objective reality; that is, a state which includes the *belief* of its objective counterpart. Most people take it for granted that knowledge is mental activity which has its objective counterpart. However, there are very many subjective truths to which an objective reality cannot correspond. Christian, Jewish, pagan, and philosophical martyrs have testified with their blood to their faiths, which in certain respects contradict each other. They must, therefore, have sacrificed their lives partly for something objectively untrue. On the other hand, there are objective truths which are not believed; for instance, theories which are rejected for some time, but later prove to be right.

We have seen how objectively correct thought originates. Let us now consider the origin of thought which includes the thought of the existence of its objective counterpart; that is, the origin of belief.

An infant has no consciousness of either reality or unreality. He has simply conscious states, without any such distinction. But he cannot fail to learn the distinction. He is hungry. He cries. He becomes conscious of reproduced former experiences of food and of the mother bringing the food. And, indeed, the door opens, the mother enters with the food, very similar to the imagined mother, and yet differing in vividness, in permanence, in number of details. At a later time the child imagines strange compositions: animals with legs both below and on their backs, so that they can turn over and continue running when one set of legs is tired; princes and princesses with golden crowns on their heads; fairies carrying marvelous gifts in their hands. But nothing of this kind appears with the vividness, permanence, and distinctness characteristic of the mother entering the door.

Human beings who appear with a similar vividness, permanence, and distinctness, either are bareheaded or wear plain-looking hats; and their gifts amount to but little. When the child imagines the experience with his mother, he recalls the substitution of the vivid and stable consciousness for the feeble and fleeting image of the mother and the food. When he imagines his dreams of princes and fairies, he recalls the substitution of those vivid but homely mental states for less vivid but more beautiful ones. When such experiences have been repeated hundreds of times, the child begins to realize that there is a distinction of the greatest importance between the two classes. He forms the abstract concepts of sensory perception and of fancy — of consciousness of various sensory qualities and characterized by indescribable vividness, permanence, and distinctness; and on the other hand, of consciousness of various sensory qualities and characterized by feebleness, fleetingness, and vagueness, and in this respect flatly contradicted by the mental states of the other kind. *In these abstract conceptions consists the consciousness of reality and unreality.* Reality and unreality are not logical opposites, but merely relative concepts.

As soon as the ideas of reality and unreality are once formed, ample opportunity is found for their application. They are applied also to cases which do not belong to either of the extremes of vividness, permanence, and distinctness, or feebleness, fleetingness, and vagueness. Finally, they are applied by mere analogy to cases which do not directly call for their application — as in a discussion of historical truths. At this point another distinction is made. Trees with leaves of silver are never presented to our sense organs. But the elements which make up even the most contradictory compounds of fancy have been



known through the sense organs and become known again as sensory impressions. Trees with a foliage of silver are not seen in everyday life; but trees are seen, and leaf-like things of silver, too. Even if all our ideational thought were fancy, its elements would tend to make us conscious of the concept of reality rather than of unreality because separately the elements have often been experienced with a high degree of vividness, permanence, and distinctness. The opportunities for thinking of reality are incomparably more numerous in human life than those for thinking of unreality. We develop the habit of conceiving our thoughts as real, unless there is a positive force compelling us to accept the opposite concept. Thus we understand why the child, as soon as he has formed these two concepts, is immensely credulous.

Tell the child that the moon is going to drop from heaven, and he will look up, expecting to see it fall. The child's experience is limited. There is but rarely a positive force tending to reproduce in his consciousness the concept of unreality. Where there is no such force, the child does not remain neutral, skeptical, but conceives his thought as including objective reality. Language assists in this tendency, for the first words acquired by the child mean objective realities, persons, clothes, furniture, and so on. The frequent use of these words strengthens the habit of thinking of things as realities. Of much influence is also the use of the verb *to be* as a mere copula and also in the sense of *to exist*. The child is thus induced to regard a thing as existing because it is thought *to be* yellow, round, etc. That *to be* is used in this ambiguous manner in all languages seems to be additional proof of what is historically certain, that the human race, like the human child, has passed through a period of extreme

credulity. This racial credulity through the traditional usage of language contributes now to the credulity of the individual.

Gradually the child's experience becomes more extensive and begins to exert upon the multitude of original beliefs an influence which sometimes continues all through life, although ultimately the progress becomes very slow. Experience steadily encroaches upon the realm of belief, driving it from ground which it previously occupied. It also gives additional authority to belief, enabling it to hold more firmly that to which previously it possessed but a doubtful title.

Much that contradicts frequent experiences is taken out of the realm of belief and called a fairy tale or a story. Trees with golden apples? There is no such thing, the real apples assert — we are all mellow and meaty, not hard as gold. A Santa Claus who distributes gifts to all the children everywhere at the same time? Impossible, says everyday experience. He who is here cannot also be yonder and in a thousand other places.

On the other hand, experience gives strength to the child's belief. Single matters of belief are connected mutually and with the absolute basis of all knowledge, the sensory perceptions of the present. When I am obliged to think, however briefly and vaguely, that as really as I now see this paper and perceive the words printed on it, I was at that particular time, previous to those and those events of the meantime, at a certain place witnessing a certain act, my belief in the reality of this event is unshakable. Whatever can be connected in this manner with this fixed point, is itself fixed, placed beyond doubt.

Why can I believe my dreams while I am dreaming them, but not after waking up? Because consciousness is

limited during sleep. There are *no perceptions* with their normal vividness, permanence, and distinctness, with which the dream may be compared as to its reality. There are but *few other ideas* accompanied by a vivid idea of reality, with which the dream may be compared. The dream has therefore the *maximum of reality* of all mental states present at that time in the mind. This is meant when we *believe* our dreams while we dream them. In a dream it may seem real to be shot toward the moon in an immense shell in company with other people, as in Jules Verne's story. But in waking life this thought is altogether devoid of reality. In comparison with the reality of my present experience and of my ideas of the limits of engineering, of the low temperature of interstellar space, and so on, that thought of a journey in a shell immediately makes me conscious of the vivid idea of unreality. I cannot believe that story.

We call a verbal statement *proved* as soon as the connection between it and our present experience has been established in such a manner that the idea of reality is aroused in our mind. The believing of that which has been proved is called *knowing*. Belief is often used in a narrower sense, excluding that which is known and including only that which does not arouse either an idea of reality or an idea of unreality. Both usages are justifiable, the narrower one and also the wider one. Knowledge and belief are opposed as well as related. It is of much practical importance to distinguish that which has been proved from that which has not been proved. But it is also of practical importance to distinguish that which is surely unreal from that which is merely unproved. It is quite impossible in human life to prove every statement before we permit it to affect our thought and our action.

The chief thing which a man must have learned when he arrives at maturity is this: that the number of facts to be believed is very much smaller than he thought originally. The belief of childhood and youth is subject to continuous losses. Something is, indeed, confirmed and strengthened by growing experience; but it was believed before it was known, and cannot properly be called an additional belief. Much that has been believed for some time is recognized as unreal. That apparent errors have to be recognized as truths happens much more rarely. Experience makes a man more and more skeptical, cautious. This is of great advantage to him in his adaptation to the world, and higher institutions of learning to a large extent have their purpose in aiding the young to develop cautious, critical habits of thinking. A student goes to college not merely in order to cram himself with bare facts, but to be trained in the habit of seeing men and things in the abundance of their relations, of asking for their passports before granting them free passage.

Thus the original tendency to believe is gradually limited, more in one individual, less in another. But it is never perfectly eradicated. This, indeed, would not be advantageous. A limited tendency to believe is indispensable. Two conditions contribute chiefly toward the retention of a belief which can be neither proved nor disproved: authority and personal needs.

"He told us so" is reported to have been a common remark among the disciples of Pythagoras. And to the present time disciples of any master have not failed to quote their master. It is not even necessary to be a master in order to be a prophet. A strong voice, significant gesticulation, and impressive speech are sufficient to guide the belief of the masses of the people. When everybody holds

a certain belief and gives expression to it, no member of the crowd can escape the influence of the constant repetition of the thought. I cannot help believing what my friends or my associates in a profession believe. Even if I begin to reflect on the reasonableness of accepting as a truth what I have merely often heard, I can hardly free myself of the belief. Is it not highly improbable that all of them should have been led into error without noticing it? On the consensus of everybody, philosophers have frequently founded their highest doctrines. Cicero calls it the voice of nature. On the other hand, narrow-minded people often attempt to fight a truth which they dislike by pointing out partial disagreements among its adherents.

But the belief in statements which are neither proved nor disproved is not always based on authority; that is, produced by emphatic and often-repeated expression of these statements by the people among whom we live. It is frequently the result of strong and deep-seated needs of the human mind. As long as these needs make themselves felt, they call up in the mind ideas of remedies and means in harmony with analogous experiences; and unless these remedies and means are contradicted by other experiences, they are believed. One may call this, in distinction from the authoritative belief, practical or emotional belief.

Every one believes in his own destiny. Every mother believes in her son. Napoleon believed in his star. A general who doubts if he is going to win the impending battle has already half lost it. Can he prove it, that is, can he interpret what he sees and what is reported to him in such a manner that the idea of his winning the battle cannot appear in his mind without the idea of reality? He is probably very far from giving his experiences

such an interpretation. Of course, he will do his best in order to make victory come his way. But his knowledge constantly informs him that the outcome is dubious. Yet this knowledge does not keep him from believing that it is not dubious. [He cannot help believing it. His whole existence depends on this belief. His honor, his future career, his nation, all is lost unless he wins. The idea of loss is impossible. It is inhibited by the idea of success, by that idea which alone can give him the prudence and presence of mind that are needed.

Or the mother who believes that her son will turn out a respectable man, does she do it because of her experiences? Her experiences are perhaps opposed to her belief; she believes, nevertheless. Circumstances were unfavorable to her son, his father does not understand his real nature, he merely enjoys his youth: thus she comforts herself. Experience is not the foundation of her belief, but her belief interprets her experience. The belief is founded on the fact that she needs it. The idea of a wayward son would deprive her of the most valued part of her existence. Therefore she cannot believe it.

Misfortune of any kind has a marvelous belief-creating power, because it constantly revives ideas of remedying the misfortune. "Whoever has lived among people," says Spinoza, "knows how full of wisdom they feel, insulted if any one should offer any advice, as long as their affairs are prosperous. But let misfortune overpower them, and they are willing to ask any one's advice, and to accept it, however senseless and ill-considered it may be."

Experiential, authoritative, and practical belief differ according to their sources, but they appear in life in various combinations. However, one of three kinds can usually be found to be the chief component in a system of

conviction. That we cannot escape the authoritative belief is plain. Who could repeat every observation made by others in order to avoid the possibility of accepting erroneous reports? Practical belief has different limits according to the amount of experience possessed by each individual. And a whole class of people having about the same kind and amount of experience may thus be distinguished from another class by their practical beliefs. A practical belief of one, which is not shared by another, is called by the latter a superstition. How much superstitions differ and how much they change is well known. Recall, for example, a superstitious means of improving one's looks, of curing diseases, of regaining a lost love. But wherever a superstition is difficult to contradict because it is so stated as to concern only that which is beyond experience (spiritualism), or when it is supported by a famous name, it may successfully resist all attempts at overthrowing it.

We saw that practical belief is not altogether independent of experiential belief. Neither is the latter independent of the former. When two theories agree equally well with experiential facts, we accept the one that is simpler. Not because we know that it is nature's obligation to proceed in the simplest manner possible, and that therefore the simpler theory is more likely to be correct; but because our practical needs compel us to accept a simpler theory whenever we can. We believe the Copernican theory of the solar system and reject the Ptolemaic system. Not because one is more correct than the other; but because the Copernican system combines the same objective fitness with an immeasurably greater simplicity. The simple we desire; the simple, therefore, we believe. A simple connection of a variety of things is pleasant, beautiful. It

is easy to survey it. It takes but a small amount of mental energy to imagine it. Whenever our experiences leave us a choice, we choose what is simpler. In other cases, too, practical belief comes to the aid of experiential belief. In the border regions of knowledge and within the blank spaces found within the field of knowledge, belief must take the place of knowledge.

## QUESTIONS

170. What is the difference between objectively correct thought and belief?

171. What is the wider and what the narrower meaning of "belief"?

172. How do the ideas of reality and of unreality originate in the child?

173. Why are we more inclined to apply the concept of reality than that of unreality?

174. What is the double influence of experience on the child's belief?

175. Should authoritative belief be eradicated? Give reasons for your answer.

176. Should practical belief be eradicated? Give reasons for your answer.

177. What is a superstition?

178. Why do we believe the Copernican theory and reject the Ptolemaic theory?

## B. *AFFECTION AND CONDUCT*

### § 19. COMPLICATIONS OF FEELING

#### 1. *Feeling Dependent on Form and Content*

Perception and ideation rarely, if ever, occur in the isolation in which they were shown above in order to make clear their structure: they are accompanied by, interwoven



with, feelings. A summer landscape not only looks different from the same landscape when covered with snow, but also arouses different feelings. I may look forward to the same event — an ocean voyage or an automobile tour — as a danger or as a pleasure ; I may regard an assertion as a truth or as doubtful. The ideas of which I am conscious surely differ much in the alternative cases. But still greater is the difference of feeling to which we refer by such terms as *fear, low spirits, disquietude, comfort, joy*. The exact make-up of these complexes of feeling is difficult to describe, but we may try to point out the conditions on which they depend. We shall first consider form and content.

Sensations, images, perceptions, and so on, give rise to feelings, not only on account of what they are, but also and indeed chiefly because of their manner of connection, of succession, and of spatial relation. Colors which we regard as most beautiful separately may compose a carpet whose color scheme we dislike and call inharmonious ; on the other hand, the most uninteresting gray dots may compose a beautiful design. A piece of music is beautiful not alone because of the clearness of the single tones, but chiefly because of the relations of these tones in melody, harmony, and rhythm.

One principle is generally applicable to this class of feelings : a variety of mental contents is bound together into a unity for our perception and imagination. A multitude of unconnected things is not easily perceivable or thinkable ; therefore it is unpleasant. A single thing, so simple that it cannot be analyzed into component parts, cannot occupy our mind for any length of time ; it is tedious, unpleasant. A combination of variety and unity is able to keep us mentally busy without overburdening the mind ; therefore it is pleasant.

The general principle, however, admits of a great many different applications. The unity may consist, for example, in the similarity and regularity of arrangement of the pickets of a fence. The unity may consist in subordination of a number of equal elements to a dominating element, as the larger fence post taking the place of a picket at regular intervals, or the accented element in a rhythm. The unity may consist in organic unity of the elements of a living thing. It may be logical unity, as in a sentence or a lecture. Several of these and other kinds of unity may appear simultaneously in the same matter ; and one of these unities may be subordinate to another, this again to another, and so on, as in a Gothic cathedral, a symphony, or a drama.

Thus the variety and complication of the feelings based on the principle in question is immensely great, depending on all these unities, their harmonious relation or opposition, and the contents of impression or imagination directly. This complication is further increased by the conditions discussed below.

## *2. Feeling Dependent on Association of Ideas*

Why does a sunny spring landscape give us pleasure? What is its advantage over a gloomy winter landscape? Possibly green is a pleasanter color than brown or gray, which predominate in the winter landscape. Possibly the curved outlines of the trees in their foliage are more beautiful than the naked branches appearing like a system of dark veins on a gray sky. But these are hardly the main causes of the difference in feeling, which are found rather in the different ideas associated with the one and the other percept. The spring landscape reminds one of life, warmth, travel, picnics ; the winter scene sug-

gests death and decay, cold, moisture, overheated and ill-ventilated rooms. The feelings aroused by these things when we actually experience them are likely to be aroused now when these thoughts, however fleetingly, are reproduced. For the same reason the cold sensation of touching a corpse is accompanied by a feeling differing from that of touching a piece of ice. It is a different thing to see a stream of blood or of cherry juice, and in a lesser degree even of cherry juice or milk. In every case a multitude of memories influence our feelings, or lead us directly into a train of thought of pleasant or unpleasant character. Thus the feelings which have their first origin in a simple percept may become exceedingly complicated.

An especially important consideration is that these feelings increase in intensity and finally become more conspicuous than the memories by which they are aroused. A house in which I experienced an unpleasant scene finally arouses unpleasantness directly, without any mediation by the consciousness of that event. This kind of transference of feeling is particularly noticeable when the same feeling is aroused by many different memories, quite unconnected among themselves, though attached to the same percept. No better illustration of this law can be found than the feelings accompanying the thought of money. From early childhood all through life man learns that it is money and again money on which the realization of his desires depends. A definite memory of any of these special experiences soon becomes impossible because of the competition among them. But the pleasantness originally aroused by them is not lost. It attaches itself directly to money. In a similar manner our love for our parents, our friends, our home, and so on, originates.

A reverent child may reject as a brutal theory the statement that he loves his parents because of the innumerable benefits received from them, that this love is but a kind of precipitation of all the pleasures derived from the actions of his parents and from his living with them. This rejection is in so far justified as the child's love is not a conscious deduction from the memory of benefits received. Nevertheless, it is quite certain that his love is in some way naturally derived from them. Children who are brought up by foster parents, if they are as well taken care of as by real parents, love them equally well.

We have pointed out that the idea of *I* is almost omnipresent in our thought, and that it constantly influences our feelings. To understand this influence better, we may distinguish two relations between *I* and the rest of our thought, according as this or the *I* is the predominant part of our consciousness. The former case may be illustrated by our perceiving the movements, gestures, and voice-sounds of a person or of an animal as the expressions of conscious motives. Even into the percepts of inorganic things the idea of *I* is carried in a similar manner. We speak of a bridge boldly swinging across the river, a mountain rising proudly to the clouds, a beam resting heavily on columns, lines crowding together or leaning against each other, tones hiding before and seeking each other. We attribute contents of the *I* to the things which we perceive; we give them mental life, feeling, and conduct, and experience in consequence further responses of our own life of feeling. In such cases, the influence of the *I* on our thought is obvious, but it does not predominate. On the other hand, the idea of *I* may be predominant, but may receive its special coloring from the data presented: as when I feel the

tragic fate of a hero, not merely through the sympathy or admiration which it arouses in me, but as my own pain; when in the stress and striving of a Faust I feel my own dreams and desires; when the precipice pulls me down or the towering rock uplifts me.

Since the idea of *I* is so influential for our life of feeling, it is to be expected that the opposite idea, the idea of the external *world*, is also of considerable importance in this respect. Very often we refer to a thing by merely emphasizing that it is opposed to, different from, or independent of the *self*. We frequently speak of *the world and its ways*, of *the course of the world*, meaning all its sense and nonsense, its kindness and cruelty. Naturally, this idea of the world also gives rise to many complicated feelings.

### 3. *Irradiation of Feeling*

We mentioned above that feeling is easily transferred from one percept or idea — its *substratum* — to another one which is associated with the first. A special form of this law of feeling may be called irradiation of feeling. A disagreeable message received early in the morning may spoil the whole day; the news of a great success may for some time give to every other experience a joyful aspect. Not that the unpleasant or pleasant event is constantly recalled. It is recalled now and then; and the feeling may be more intense at these moments. But the feeling does not depend on this recall. It attaches itself to any other substratum, even to one which is scarcely in any way related to the first. I have been vexed by an employee's failure to carry out an order in the proper way and by the resulting consequences. Now I am provoked to

anger by everything that happens, by a harmless question of a child, by the visit of a friend who is ordinarily welcome, by the happy looks of a neighbor, by the fly on the wall, not least by myself, being so stupid and so deficient in self-control that I give room to all this unpleasantness.

So many-sided are the complications of our life of feeling. The contents, their mutual relations, their connections in the past, the prevailing impressions of the present, all these are conditions on which our feeling depends.

### QUESTIONS

179. Illustrate the independence of form feeling and content feeling.

180. Explain the pleasantness of unity in variety.

181. Give examples of unity in variety.

182. Illustrate feeling based on association of ideas.

183. What examples are given in the text of transference of feeling?

184. What are the two relations between the *I* and the rest of our thought, important for our feeling?

185. What is irradiation of feeling?

### § 20. EMOTIONS

Our preceding discussion shows that an exhaustive description of all our complicated feelings is an enormous task. We cannot enter upon it here. But certain classes of feelings may be described in more detail; namely, emotions and moods.

Those feelings which are based on associated ideas, and which rise at once to great intensity, are called emotions. This definition is somewhat deficient in so far as it is difficult to draw the line which exactly separates

great from small intensity and a quick from a slow rise of intensity. Nevertheless, the stormy character of certain feelings not directly attached to sensory stimulation is so conspicuous that a special name is desirable. Anger, fright, distress, and hilarity are such feelings: hilarity distinctly pleasant, fright and distress equally unpleasant; anger also unpleasant, yet mixed sometimes with a certain amount of pleasure. The feeling and the consciousness of its cause are usually so intense in an emotion that there is little room for coherent thought. The judgment of a person in a state of emotion is narrow; his actions may be called shortsighted.

Those feelings which become separated from their original perceptual or ideational substratum and attach themselves to any other kind of perception or ideation — no matter what feelings properly belong to these — are called moods. They are usually, probably because of the separation mentioned, of small intensity. But their duration is often very extended. As typical examples may be mentioned grudge, worry, dejection, and cheerfulness.

Like all feelings, emotions and moods are in some way related to motor activity. Of particular interest here are not the purposive movements, which are by no means absent, but a large number of muscular activities seemingly of little or no usefulness, resulting from inherited nervous connections. In so far as these muscular activities become outwardly noticeable they are called the expressions of the emotions or moods. The angry man instinctively clinches his fist, the hilarious fellow dances about. Laughing, weeping, wrinkling of the forehead, and blushing are further expressions of this class. Contraction of the muscle fibers in the skin causes goose flesh, or the hair to stand on end. Breathing undergoes changes, becoming

quicker or slower than normal. The blood vessels expand or diminish in size through the activity of the muscle fibers in their walls, causing the subject to look red or pale, to feel warm or cold, and in the latter case to shiver. Secretion of saliva, perspiration, and secretion of the lachrymal glands may result from the changes in the circulation of the blood. Fatigue, nausea, lack of appetite, and other symptoms of internal processes may occur.

These phenomena were almost entirely neglected by the older psychology, although their significance was understood by physicians. More recently their psychological import has been recognized and even overestimated. It has been said that these phenomena not only occur in emotions, but *are* the emotions; that the emotions consist in the organic sensations resulting from these reflex muscular activities (theory of James and Lange). We do not weep because we are sorry, but we are sorry because we weep. We do not tremble because we fear a pistol held up before us, but we are frightened because we tremble. Two arguments favor this view. Let all bodily symptoms be gone, and the strongest emotion is gone too. Anger without clinching the hand is no anger. While I am sitting calmly on a chair, smiling, I cannot be angry. And further, when the bodily symptoms are exactly imitated or produced by drugs or by nervous disease, the emotion is there. Alcohol makes a person hilarious and courageous without any perception of the kind which usually produces this effect. Certain poisons or mania cause rage very much like that produced by an insult.

However, these facts do not prove that an emotion contains nothing else than organic sensations. It is obvious that, according to the laws of association, the contents of an emotion must be reproduced by those organic sensations



which were present innumerable times when that emotion was present. The organic sensations resulting from poisons or mania perhaps call up an idea of an insult, and the complete emotion of anger naturally follows. Because of the firmly established associations, it is also to be expected that the voluntary substitution of a different set of organic sensations interferes with a present emotion. Introspection makes it clear that an emotion contains much more than a mere group of organic sensations.

The instinctive motor activities characteristic of the various emotions may be classified under two headings: excitation and depression. The difference is especially noticeable in unpleasant emotions: anger is an emotion of excitement; fear, as a rule, of depression. But this distinction is not entirely absent in pleasant emotions. The joy of a grateful memory is characterized, not indeed by depression, but by a restfulness very distinct from the excited joy of expectation or the delight at a present experience, although the pleasantness felt may be of exactly the same degree of intensity. A careful analysis of these motor activities must distinguish, not only excitement and depression, but also their occurrence in either the skeletal or the involuntary muscles, the muscles of the vascular system. Thus one may distinguish four classes of emotions, as characterized chiefly by heightened activity of the skeletal or of the vascular muscles, or by weakened activity of the skeletal or of the vascular muscles. Symptoms resulting from abnormal contraction or relaxation of the vascular muscles are, for example, a person's growing pallid, or blushing, and the corresponding sensations of cold and warmth.

Two other concepts relating to the emotional life deserve to be mentioned, temperament and passion. Tempera-

ments are inherited tendencies of the life of feeling in special directions. Since ancient times four have been distinguished: the sanguine, bilious (choleric), melancholic (atrabilious), phlegmatic (lymphatic). The ancients held that temperament is conditioned on the predominance of one of the four humors, the blood, lymph, yellow bile, and black bile. This is of course pure speculation of a prescientific period. But the distinction of the four classes agrees well with common observation, although mixed forms of temperament are more common than the pure types. People are either optimistically or pessimistically inclined. The sanguine and the phlegmatic are the optimists, the bilious and the melancholic the pessimists. On the other hand, some people are excitable, impetuous, others are not easily aroused. The sanguine and the bilious are quickly excited, the melancholic and the phlegmatic are calm and sluggish.

Passions are acquired dispositions toward special kinds of pleasant experiences. We might say that they are foreseeing, voluntary emotions. We speak of the passion of the gambler, the smoker, the collector, the lover. One may also compare an emotion with an acute disease, a passion with a chronic disease. Animals, too, possess emotions, as joy, fear, and rage. But it seems that they are not sufficiently capable of anticipating emotions to be said to possess passions.

## QUESTIONS

186. How are emotions defined?
187. How does an emotion influence coherent thought?
188. How are moods defined?
189. Mention a number of moods and an equal number of emotions, each comparable to one of the moods.

190. What four classes of motor activities characteristic of emotions are distinguished in the text?
191. What motor activities are called expressions?
192. Give examples of expressions of emotion.
193. Give examples of motor activities which are not expressions of emotion, but nevertheless of much significance for the subject's experience of an emotion.
194. What is temperament?
195. What is a passion?

## § 21. COMPLICATIONS OF WILLING

We have shown in an earlier chapter how voluntary—that is, foreseeing—actions develop out of instincts. Sensations result from the instinctive action, are associated with those other impressions which called forth the instinctive response, can then be reproduced by them, and can themselves produce the action. When an action is thus foreseen, it is called voluntary. Such simple voluntary actions are then combined into complicated groups and chain-like progressions. The conscious result of the first movement calls up the idea of a further movement, its execution that of a third movement, and so on. Serial activities of this kind often go on for a long time; for example, walking, eating, dressing, writing, sewing, rowing. As experience of the relations between the external things and practice in the performance advance, such serial actions become more and more perfect in several respects. Their conscious anticipation is more and more extended, so that they may be adapted to very remote consequences, the occurrence of which is not expected until days or weeks afterward. They are more and more refined in that they adjust themselves accurately in direction, speed, and force to the special circumstances of each case. They are

performed in less time and more economically; all detail movements which are either wrong or merely superfluous come to be entirely omitted.

That the conscious processes in voluntary movements tend toward simplification has been mentioned in § 10. A whole series of movements, which was originally performed by each movement being consciously anticipated in order, is now performed without further consciousness as soon as the series has once begun. One fact, however, is highly interesting in this connection because it shows how the several movements of the series are actually caused. Although consciousness of all those anticipations of the movements is no longer required, the physiological sensory functions must run their course in the normal order or disturbances occur in the movement. This may be demonstrated in an animal by cutting all the sensory nerves of a limb, but carefully leaving all the motor nerves intact. The limb nevertheless appears paralyzed. A similar case in man has been described by Strümpell. A workman received a knife wound in the spinal cord. Complete recovery occurred, with the exception that the right hand and lower arm remained perfectly anesthetic: no kind of cutaneous or organic sensation was any longer perceived. The muscles of the hand and arm functioned almost normally. But movements, even very moderately complicated, could no longer be performed unless the man saw his hand and its movement. The illustration (figure 18) shows his behavior when requested to form a ring with his thumb and index finger. He could do this fairly well when permitted to look at his hand. Otherwise it was impossible, in spite of his will and the muscular capacity to perform this action. We see, then, that the peripheral impressions are necessary to bring about the several par-

tial movements in this case of acquired serial activity, although these impressions have long ceased to become conscious whenever the act is done.

When we anticipate a final result of an extended series of movements, it frequently happens that the movement which directly leads to that result is, for one cause or other, not immediately possible. Imagine that a person for the first time sees some one pulling a cork from a bottle, pouring some of the contents into a glass, and inviting him to drink. Seeing the bottle again calls up in his mind the



FIG. 18.—VISUAL AND KINESTHETIC CONTROL OF VOLUNTARY ACTION: THE FORMER INTACT, THE LATTER LOST.

idea of a delicious beverage and the movement of drinking. But drinking is impossible, for there is no glass, and the bottle is corked. In such a case the idea of the result, which because of its importance is being kept constantly in mind, unrolls the total series of ideas in the reverse

order. It calls up first the thoughts directly preceding the final result, then the thoughts preceding these, and so on, until an idea is reached which can be realized by a movement. In our example the person becomes conscious of the idea of pulling the cork, of the corkscrew used for this purpose, the place where the corkscrew was found hanging, the movements of preparing it for the task, and a similar set of ideas for the glass; and he thus becomes able to carry out the whole series of movements which result in the taste of the beverage.

### QUESTIONS

196. Give examples of serial activities of the foreseeing kind.

197. In what ways are activities of the kind just mentioned perfected?

198. What is the relation of sensory activity, consciousness, and performance in perfected serial movements?

199. Illustrate by a pathological case the relation just spoken of.

200. What rule is illustrated by the example in the text of pulling a cork from a bottle?

### § 22. FREEDOM OF CONDUCT

As experience of the connections, complications, and consequences of things advances, the ideas called up by any impression must clearly become very numerous. Ideas of near and remote, probable and improbable, desirable and undesirable, consequences, — ideas of fit and unfit, direct and indirect means of bringing about or preventing those consequences, — ideas of difficulties and obstacles, facilities and openings must tend to appear, to compete with each other, to disappear and reappear in rapid succession, or merely to approach consciousness ready to appear when their services should be needed. We refer to these various

mental states, according as they appear in one or another form of connection, by such terms as *reflecting, considering, choosing, desiring, rejecting, intending, deciding*, and many others, all having in common the foreseeing of something to be experienced in the future as the result of our action.

What action occurs in each possible case depends on the relative force of the factors coming into play. The actual sensory impression is as a rule a rather insignificant factor. It sets free the ideas derived from innumerable previous sensory impressions. The resulting action is then nearly always extremely different from the instinctive reaction belonging to the sensory stimulation. Such actions, resulting essentially from factors *within* the mind, not from external factors which happen to impress the mind at the moment, are called *free* actions. Their freedom does not mean that they have no causation, that they are free of causes, but they are free of the compulsion exerted by the external stimuli of the moment. They are free actions as opposed to instinctive actions, which are not free of these stimuli of the moment, but on the contrary, completely determined by them.

Scholastic philosophy — and popular thought, which is still largely under the influence of that philosophy — recognizes still another kind of freedom of the mind. It assumes that mind, under the impression of perfectly definite external conditions and with perfectly definite internal motives of thought and action, possesses the faculty of deciding in favor of the action opposed to its own motives and of enforcing this action. This faculty of an absolutely causeless willing is assumed to be added to all the other external and internal factors determining action or, as the case may be, suppressing action. Such a faculty we can-

not accept, since according to our most fundamental conceptions *mind* is not a being added to its experiences, but the totality of its experiences, in so far as it knows itself; whereas it is called *brain* in so far as it is known by other minds. The arguments brought forward in favor of a freedom of the will in the sense of a possibility of causeless action are unacceptable to the psychologist because they would make a psychological science impossible. Nevertheless, it is worth while to discuss the more important ones briefly.

Three arguments are most commonly offered. First, immediate experience tells us that, whenever we decide in favor of one action, we could have decided differently. We were conscious of the possibility of acting otherwise. The second and third arguments are of a practical nature. According to the second, the idea of a uniformly effective causation of our actions paralyzes our activity. If everything takes place by necessity, the idea of influencing the physical world or human society becomes meaningless. No one can believe in determination of our action and at the same time make an effort to instruct and educate people to act differently. Thirdly, no one can be held responsible for his actions if he could not help performing them. If all actions are causally determined, punishment becomes mere cruelty.

The first argument fails because our immediate experience under no conditions informs us exactly as to what caused and what did not cause our actions. We have just seen that a serial movement cannot be carried out unless constant sensory impressions are received from the progress of the partial movements. Immediate experience gives us no information about this necessity, which was entirely unsuspected until physiological experiment and



pathological observation revealed the fact. Immediate experience tells a person who in his boarding house praises a very ordinary dinner in exaggerated terms, that *he might have kept silent* as he usually does—he does not remember that the evening before when he was in a state of hypnosis a suggestion was given to him to praise his dinner the following day. Everybody else knows that he will, that he must, do it. He alone thinks, on the basis of his immediate experience, that it was an act of free will without causation. It was free, uncaused, in the same sense in which the issue of a disease, the outcome of a war, the weather, the crops, are free and uncaused; that is, *he was ignorant of the cause.*

Paralysis of activity is said to be the consequence of a belief in universal causation. But surely the energetic and ambitious man is not paralyzed by this belief. He feels that he is the tool used by nature to shape the destinies of the world. How could a consciousness of his importance in the causal connections of events paralyze his activity? The idle and indolent may excuse his lack of activity by saying that it is his nature to love inactivity, that he cannot help it. But who would have any more respect for him on that account? Of course it is not his belief in universal causation that makes him indolent. The lesson from history is very significant in this respect, but it must not be read one-sidedly. It is all right to point out that the fatalistic Islam is losing piece after piece of its dominion. But the same fatalistic Islam also conquered a world and for centuries kept all Europe in terror. Thus it cannot be its fatalism that determined both its rise and its downfall. In recent years, did the belief in predestination make the Boers less energetic than the belief in freedom the orthodox Spaniards?

We must say, then, that in general neither belief is of much practical significance. But as a guide in special cases the belief in universal causation is by far preferable. What can give more encouragement to the educator than the conviction that his efforts will bear fruit in one way or other because they must help to shape and direct his pupil's activities in later life? What can be more discouraging than the belief that, whatever may be his efforts, they are just as likely to be lost on his pupil as to be effective, since the latter has the faculty of causelessly acting either in one way or in the opposite way?

The third argument asserts that universal causation is incompatible with responsibility. But what do we mean by responsibility? Nothing but the fact that society, if it can do so, will punish its members for certain deeds. Why should a belief in universal causation prevent society from punishing its members? Bismarck writes in a letter to his sister: "It is not the wolf's fault that God has created him as he is. That does not prevent us from killing him whenever we can." Holding a person responsible, punishing or rewarding him, does not lose its meaning if we regard his actions as being determined by causes. We do not then hold him responsible for the single act, but for his being so natured that under such circumstances he cannot help committing such a deed. The question becomes this: What is the more plausible reason for punishing a person, his abnormal deed or his abnormal, unsocial nature which made this deed possible?

It is true that punishment dealt out by an individual or a small group is often merely an instinctive act of revenge for a single deed. If a person beats me, do I have less pain if I beat him and cause him pain too? Should a gambler beat the roulette because it makes him lose and

the other man gain? Would the roulette act differently for having been beaten? Am I sure that the person whose beating me was undetermined by causes will treat me better the next time? If his actions are caused, he probably will treat me better because the memory of the blows received from me will act as a cause. The instinct of returning blows would be incomprehensible if human action were independent of causes.

But the legal punishment dealt out by the officers of a nation has lost the significance of an instinctive act of revenge. Does this fact make it compatible with the doctrine of causeless activity? Would not punishment, under this doctrine, be cruelty pure and simple? Punishment can be justified only if it can act as a cause determining human behavior. Society introduces fear of threatened punishment and memory of suffered punishment as motives into the mental life of its members, in order to inhibit criminal actions in those who are so natured that they will commit acts inimical to society when occasion offers, or when they are tempted. The degree of the penalty is adapted to the effectiveness of the temptation under different circumstances. Children and intoxicated and insane persons are treated in a different manner because the fundamental condition of punishment—the existence of an idea of punishment capable of serving as a motive of action—is not fulfilled in them. All this becomes entirely purposeless, meaningless, if we accept the doctrine that human actions are not completely determined by causes. Responsibility, social order, and law, far from being called in question by determinism, are, on the contrary, dependent on it for their justification.

Indeterminism, the doctrine of causeless activity of the mind, of freedom of a will which is regarded as an entity

added to the contents of the mind, is no better supported by these special arguments than by general considerations. More than a hundred years ago Priestley said of this doctrine: "There is no absurdity more glaring to my understanding."

### QUESTIONS

201. Give at least a dozen words all meaning the foreseeing of a future experience resulting from action.

202. How are free actions defined?

203. What other name is mentioned in the text for unfree, compulsory action, a name which has already been much used in a previous chapter?

204. What are the three arguments mentioned in favor of the assumption that causeless action is possible?

205. What do we learn from a post-hypnotic suggestion with respect to the question of free will?

206. Give examples from history showing that both energy and indolence are independent of theories about the will.

207. Can the belief in causeless activity be expected to contribute to educational endeavor? Give reasons for your answer.

208. What is the aim of legal punishment? How is this aim related to the doctrine of causeless activity?

209. Why are children not made subject to legal punishment?

## CHAPTER IV

### HIGHEST ACCOMPLISHMENTS OF CONSCIOUSNESS

#### § 23. EVILS OF KNOWLEDGE

INTO the remotest distances, spatial and temporal, mind penetrates through the accumulation and theoretical elaboration of experiences. Knowledge may be obtained of the names and the deeds of Assyrian kings, of the shape of the oceans and the continents thousands and hundreds of thousands of years ago, of eclipses of the sun and the moon, of the appearance of the starry sky for any number of years hence. Knowledge means power. Insight into the relations of things enables the mind to adapt itself more perfectly to them. Science and industrial development are the results of this advancement of mental activity.

Nevertheless, it is not exclusively happiness that is thus gained. So complicated is mind that what contributes to its welfare and removes obstacles to its well-being, at the same time creates new sources of unhappiness, which call for new means, new methods, of relief. "*La prévoyance, la prévoyance,*" complains Rousseau, "*voilà la véritable source de toutes nos misères.*" We must make allowance for the exaggeration necessary to make the desired impression; but even then there is much truth in Rousseau's words. Not all evils spring from prescience, but a good

many do. Three classes of unintended and unpleasant effects of knowledge anticipating future events may be described.

As our knowledge expands we become more and more impressed with the narrow limits placed on this expansion, with our insuperable impotence in so many respects. To a child, who knows little and accomplishes little, his inability, his helplessness, does not give much concern. It is the prevalent, one may even say normal, condition of his life, and therefore scarcely gives rise to unpleasant feelings. But the experienced adult, in the full consciousness of his knowledge, of the advantage which this gives to him, strives to know everything, to extend his power over everything. And he is constrained to learn that he will never come near this end. His prescience, the source of so much pleasant feeling, becomes thus a source of immense unpleasantness. Highly important relations of things remain in almost total darkness. Not even the next day's weather can be foretold, not the issue of the imminent battle, not the bent of the woman he woos. How numerous are the things against which he is almost powerless : human enemies, wild beasts, storm, earthquake, fire, flood, famine, a host of diseases, and last of all the inevitable death. He foresees all the terrors, aware of their power over him. This must fill his life with anxiety and bitterness. "He whose eye is so keen that he sees the dead in their graves, no longer sees the flowers blooming."

Other evils have their sources, not directly in the mind's foreseeing, but in the limitations of foreseeing activity. The most fundamental aims of human activity are self-preservation and the preservation of the species. But our feelings indicate that a third class of activities are essential for the completeness of human life, although their contri-

bution to self-preservation and to preservation of the race seems to be limited. The aim of these activities perhaps is only a training of our powers of attention, of unifying in consciousness a number of impressions which indirectly might benefit the two aims first mentioned. Even primitive man devotes a considerable part of his activity to the production of these effects — esthetic impressions from colors, from tones, from symmetry, from rhythm. He ties feathers into his hair, dyes his clothes, and constructs his implements in symmetrical design without being forced by their use to do this. He works rhythmically, either himself or with others; he dances, thus uniting successive movements into regularly repeated groups. But those activities which serve the purpose of self-preservation and race-preservation directly, often occupy his mental energies so exclusively that no time is left for the exercise of these esthetic tendencies. Their suppression then results in deeply felt unpleasantness.

The activities of preservation are a source of evil in still another way. Whatever pleasure they may give, they do not give a lasting peace. As soon as one goal is reached, it appears as a mere stepping stone to a further one. Why does the merchant earn money? In order to earn more money! The fisherman's wife in the fairy tale, who had been beggarly poor all her life, did not enjoy the comfortable cottage given to her for more than eight days. Then it appeared small and homely to her, and she desired a castle. This obtained, it took only a day to have her wish to be king. And immediately after the satisfaction of this desire, she asked to be made emperor. It is true, not every one is always thus rent by his cravings: the fairy tale places the sober husband at the side of the greedy woman. But a ceaseless, insatiable longing seems to be,

in varying intensities, a normal element of human nature. When the attainment of a further end appears clearly impossible, a quiet enjoyment of one's possessions may be the natural consequence; but even then there is no lasting peace, for the tormenting experience of tedium takes the place of unsatisfied longing.

A third class of evils take their origin from the effects of foreseeing activity, not only on the acting person, but chiefly on the other members of society. The natural endowment of different individuals for the struggle of preservation differs greatly and results in corresponding differences of achievement. In small communities, for instance in the family, the favorable results obtained by one are shared by all. But as larger social groups are formed, this becomes impossible. The results of the individual's labor remain with him or at least within a smaller circle. This is the origin of property. Certain members of the social group not only procure more, but through the possession of desirable things become able to hire others to work for them. This enables them to increase still more the rate of accumulation of wealth. Thus a chasm is opened between masters and servants. However, his nature compels man to seek the companionship of other men, and this tends to bridge over the chasm. But between one community and another community a similar chasm remains. To steal from the members of another community, to rob them by force, to make war upon them and carry off the plunder, is the same as to rob an apple tree of its fruit or to kill a sheep. Property thus obtained naturally passes into the hands of the masters, increasing their own and their offspring's powers. The final result is the existence of enormous contrasts: blessedness of a few and wretchedness of the



multitude. The total balance is bad: there is more evil in the world than good.

Of course, those who have secured their masterships will say: Why should it be otherwise? Why should a low level of development of human life in all be preferable to a vastly higher development of a few and a still lower one of all the rest? And those youths who are not yet masters, but feel confident of being destined to become masters, readily applaud. There are, however, at least two objections to this view. First, we must remember that all human thought and feeling is determined by the laws of association. The masters cannot help seeing the wretched condition of the slaves, and must thus suffer themselves, although much less. This interferes with the enjoyment of their privileged condition. But the diminution of their happiness on this account may amount to little if they avoid the sight of poverty whenever possible; and that part of it which they cannot avoid seeing, they get accustomed to.

The following objection is more serious. The slaves are not likely to adopt the view of their masters that the contrast of their positions is the natural and just outcome of their respective endowment with bodily and mental abilities. They easily notice that this is only partly true. Especially the rewarding of sons for the merits of their fathers or grandfathers does not find favor with them. Their practical belief — supported by the strongest desires and nourished by the comparison of their own condition with that of the masters — keeps before their minds ideas of improving their lot, even of becoming masters themselves. The authoritative belief in the excellence of the present status, in spite of generations having become accustomed to this status, loses thus much

of its force. The slave class is restless and little to be relied on; therefore it must be bridled. The chasm between the classes becomes an abyss. Coöperation between all the members of society, though instinctively wished for and so necessary, is made impossible. A whole nation is torn up; its resistance toward attack from outside is diminished. The strongest people is one whose motto is: all for one, each for all; sooner or later it will overthrow the other. If this does not happen, the internal stress is likely at some time to become too great: the slaves rise and sweep the masters away. In either case the existing society is destroyed.

Notwithstanding the happiness which our foreseeing activity gives us, it carries with it three classes of evils: resulting from the limits of our knowledge, from the limits to which our activity is subject, from the contrast and enmity between social classes. Are there any ways for our mind to overcome these evils? There are some, not absolutely exterminating them, but at least restraining them, keeping them within bounds.

## QUESTIONS

210. What are the three evils originating from the evolution of the foreseeing mind?

211. What are the two subdivisions of the limitation to which our active tendencies are subject?

212. Why does the third class of these evils not exist in small communities?

213. What are the two objections to the theory which regards the division of society into masters and slaves as entirely satisfactory? Which of these objections is the stronger one?

## § 24. RELIGION

Aid against the evils resulting from the limits of knowledge is sought by the human mind in religion. When fire threatens our property, we think of water; when the enemy presses upon us in battle, we think of our comrade. By analogy, when we are under the pressure of uncertainty, in the terror of a great danger, we think of some person or some power that might aid us. We have seen previously that primitive man regards everything as animated and every event as caused by motives like his own. He regards himself as a double being made up of a heavy body and an exceedingly light, shadow-like thing, a soul. In his dreams he recognizes clearly the independence of the two: the soul leaves the body, flies to known and unknown regions, and experiences there the strangest things. Likewise in death. To-day a certain person talks, moves about, does good or harm; to-morrow the same person lies stiff. It is true that one cannot see the cause of this change, but the simplest explanation is obviously that something, the bearer of his powers, has escaped from the body and now rests invisibly elsewhere. Furthermore, are there not those who feel that they are possessed of a demon who compels them to roll about on the ground in convulsions or to attack other people?

Accordingly, man populates everything between heaven and earth, animals and plants, rocks and logs, lakes and streams, the phenomena of the weather, and the constellations, with demons, ghosts, departed souls, specters. These beings are thought of as possessing human-like powers, many of them, however, far mightier than man, handling all those things of which nature consists in a manner similar to man's handling of his own property. Some have

asserted that man animates the world because of an irrepressible desire for theoretical explanation. But this is scarcely true. Primitive man has no such longing for theories. He does it simply for the sake of his practical interests : in order to make use of the things of nature, he must first comprehend them ; and what manner of comprehending them would be preferable to humanizing them? If the things are like men of his acquaintance, he knows how to obtain their favor, their aid. His belief in these demons is a practical belief like the belief of a mother in the future of her son. These demons must exist, for he would have to give up the struggle for life, perplexed, helpless, if they did not exist—if the world were a mass of incomprehensible objects.

Naturally he distinguishes two kinds of demons, as he distinguishes two kinds of men, good and bad. Those who are malicious and hostile bring all the distress of diseases and terrible events, from which he cannot defend himself by his own power. The best one can hope to obtain from these demons is that they stop exerting their evil influence. Man lives in constant fear of them. The demons of the other kind are friendly and helpful. They assist man in his defense against the fiends and in his fight with other men ; and they permit him to participate in their knowledge of the future. They are reliable. One is grateful to them and loves them. In the most primitive stage of mankind fear prevails, and therefore also the belief in harmful ghosts and demons. On a higher level of culture, advancing insight into the causal relations of natural events brings about more self-reliance, more hope, and consequently also a growing belief in benevolent demons. Both fear and love, however, remain characteristic of the attitude of man toward his gods.

In order to obtain the good will of the gods, man naturally treats them as he would treat his neighbors. He must earnestly pray to them, flatter them, perhaps also threaten them, promise gifts in exchange for their aid, vow continued faith and obedience, especially make them presents in advance. Prayer, vows, and sacrifice are the means of approaching them. Soon another thought becomes prevalent. In cases where the influence of demons seems particularly conspicuous, in mental diseases, certain persons show themselves much more skilful than the majority in establishing relations with them and thus curing these diseases. One naturally employs these persons in one's relations to the gods. The medicine man becomes a priest. And he soon establishes himself firmly in this position by inventing mysterious ceremonies with which he alone is familiar, and by acquiring the ability to read and interpret sacred books. His authority, however, rests on his doing what the people expect from their gods: he must possess prophecy and witchcraft. Even the apostles prove their legitimacy by prophesying and performing miraculous cures.

Fear and misery are the parents of religion; and, although it is propagated in the main through authority, it would long ago have become extinct, if it were not born anew out of them all the time. In times of need and oppression religion grows strong. The churches are full, pilgrimages are common, in wars or epidemics. In battle, in disease, aboard a sinking ship, many a one learns to pray. Some fear or some need is always present. Even the highest wisdom and power can only repress, never exterminate these. Therefore they have always brought forth religion and will always do so, provided one does not clumsily attempt to change human nature.

Prayer and sacrifice are not invariably followed by success. But aid requested from human beings also is often refused, so that explanations for the lack of success are not wanting. Perhaps the prayer was not fervent enough, the sacrifice not offered in the correct manner or at the right place. Or the supplicant has offended the god; it is only to be expected that he is thus punished for the offense. Or the god, knowing his most secret failings, wishes to test his faith, his piety, in case all worldly goods and even health are lost. The gods are all-wise: who could understand them and their actions completely? Now and then, when the pious continue to suffer and the godless to prosper, religion is exposed to a serious danger. But religious faith has found the solution of this problem, not everywhere on earth, but here and there; and out of a secret doctrine of certain sects of ancient Greece this solution has become a gospel spread all over the earth: even that hope which remains unsatisfied at the time of death will find its realization. Man's soul is eternal, is only temporarily united with the body, and when separated from it will continue to live forever. The pious must prepare himself for the future life by turning away from bodily pleasure toward God, by suffering. The godless, who has failed to prepare himself, finds eternal punishment waiting for him.

Under primitive cultural conditions, when everybody has to do every kind of labor for himself, the same régime is applied to the gods. They do not differ much in their abilities, although one can do this, the other that, somewhat better. They are an unorganized crowd like mankind, fighting each other and forming alliances for this purpose. When human societies become established, the gods become differentiated. There are masters and servants,

various professions. Complications arising from such occurrences as subjection of one nation to another and a consequent assimilation of their religions, change but little the trend of this development. Of greater influence are the growth of morality and the advance of scientific knowledge.

When man establishes a moral ideal for himself, he applies it to his gods. His gods become moral examples. They no longer require bloody sacrifices, but a clean heart and good deeds. And since there is only one morality, and morality is the chief attribute of Deity, there can be only one God. All those great religious teachers who contributed to the moral development of religion, the Jewish prophets, Zoroaster, Plato, accepted monotheism.

When scientific knowledge advances, when more and more of the phenomena of nature are found to obey simple laws, daring philosophers assert and convince others that all natural phenomena obey such laws, that nothing in nature depends on the whims of human-like wills. Religion, then, seems to be deprived of its foundations. If God does not arbitrarily interfere with the laws of nature, how can any aid come from him? However, the need of religion remains, and religion adapts itself to the new views of the world. The highest form of religion is the outcome of this development. Prayer, then, has a purely mental value for him who prays. It gives him hope, confidence, courage, and thus he succeeds in accomplishing that of which he seemed incapable without aid. The witchcraft of the priest is reduced to a purely mental influence. In the sacrament he brings about a sanctification of the mind. God, far from being lost from the world, is regarded as the world itself, the source from which every phenomenon of nature springs. And again religion can give man what

he longs for, protection from the overpowering unknown, peace for the restless heart.

But life is like a hydra: as fast as one head is hewn off, two others grow. Man overcomes the depression caused by his feeling of impotence by the help of religion, and immediately has two other troubles besetting him.

(1) It is natural that of all the creations of mind religion possesses the strongest inertia. God is unchangeable. But knowledge is changeable: our ways of thinking of the world differ greatly from those of a thousand, five hundred, or a hundred years ago. Much knowledge has become attached to religion. Shall it remain unchanged on that account? The resulting disharmony has been felt at all times, in varying degrees of intensity. The representatives of science cannot help contradicting the faith of their ancestors; and the priests profess that they alone possess true knowledge, that the knowledge of the scientists is merely a mass of hypotheses. Bitter was the struggle about the geocentric system, and no less bitter more recently was the opposition to the theory of evolution. During the later centuries of antiquity scientists tried to comprehend the influence of the sun on plant life by conceiving its power as emanating and yet constantly remaining in its former strength at the point of its origin. The early Christian theologians were very modern in their scientific theories. Could they compare God with anything else better than with the heavenly body on which all earthly life depends? So they developed the conception of emanations flowing from God without diminishing his former powers, that is, the Christian doctrine of the Trinity. Other religions of the time accepted similar emanation doctrines: the Philonic philosophy recognized a twofoldness, the Neo-Platonic a fourfoldness of God.



To-day every schoolboy is taught that the sun cannot produce any effect on earth without losing so much of its energy. The ancient theory of emanations has long ceased to have any scientific significance. But the formula exists, and is still thought by many to be the basal concept of the Christian religion, so that the dissension is endless.

(2) Religion is a weapon in the struggle for preservation for him who possesses it ; but it soon becomes a weapon also for the others. It is a weapon for the priest, who uses it as the physician uses his knowledge to make a living. There would be little trouble on this account. But religion is, naturally and unfortunately, a mighty weapon in the hands of the masters defending their positions against the slaves. Religion gives peace, quiescence, to the human heart. Religion perhaps teaches that the splendor of wealth is insignificant, worthless ; that the poor are better off in the future, eternal life, than those who are now rich. Religion perhaps even teaches that those who do not believe this will be severely punished in the next life. This is not the original meaning of the doctrine — that the wretched should remain wretched ; it was meant merely to comfort them in their distress. But the doctrine obviously permits this application, and so the masters have always eagerly adopted religion as one of their safest supports, far superior to brutal force, since it does not incite revolutionary reaction. “Throne and altar” is a motto of kings. When the servants recognize this effect of religion, they naturally tend to free themselves of it, and tremendous conflicts result for human life.

Will mind succeed in overcoming these difficulties by a new form of adaptation ? We cannot tell how, since thus far it has not succeeded.

## QUESTIONS

214. What does not, and what does, cause man to populate the whole world with demons and specters?

215. What is the chief division applied by man to the hosts of demons? Do the contents of these divisions tend to change gradually?

216. How does priesthood originate?

217. Is it probable that religion will ever cease to exist?

218. What are the consequences of the fact that prayer and sacrifice are not always successful?

219. How does the growth of morality influence religion?

220. Is science inimical to all religion or to special forms of religion?

221. What are the three illustrations given in the text for the difficulties arising from the attachment of science to religion?

222. What is illustrated in the text by the quotation "throne and altar"?

## § 25. ART

The second class of the evils which we mentioned as resulting from our foreseeing activities consists in an insufficient occupation of the active tendencies of the mind. The remedy is found in art, in the enjoyment of works of art.

A work of art may cause a pleasant feeling by inciting any of a large number of mental activities. Beyond giving pleasure it has no purpose. Choice articles of food, new clothes, a profession yielding a good income, give us pleasure through their odor, their look, through the standing they give us in good society. But they please us also, and indeed chiefly, through their purposes: we need them for our existence. Because of their purposes they do not give us pure pleasure: they make us want better food, better clothes, a better position. A work of art, on the

other hand, may in some way further our life ; but he who enjoys it is not aware of such a furtherance. He sees no purpose in it. He experiences a bliss of heaven, not pleasures of the world. The purpose of art consists in its own unity ; it does not draw us away from where we are. It gives us rest while it keeps us active. The pleasure resulting from this kind of activity is called esthetic pleasure.

Many are the origins of art. Religion is doubtless one of them. Primitive man conceived of some of the most important of his demons as having their seats in certain species of animals. The possession of these animals gives witchcraft. But it is difficult to carry them about, and killing them is of course out of the question. Primitive reasoning then accepted an image, a picture, as having about the same effectiveness. So man came to carve such pictures on his weapons to make them stronger, to carry them hung around his neck to protect him, to make idols of his gods which he could visibly reward or punish. The pleasure of seeing these images then gave them a value separate from their religious applications. Yet pictures of the virgin and of saints still continue to be used for the earlier purpose. When thus beginning to be separated from religion, art became again attached to it ; for man, enjoying pictures, offered them as presents to his gods, so that they, too, might enjoy them. The subject of representation was naturally the gods themselves, the most sublime subject known to man.

Another origin of art is play. We said that play is that mass of instincts, common to man and animals, which brings about an exercise of the capacities necessary for preservation at a time when no special purposes demand such exercise. In this absence of a special purpose consists

the ultimate relation of play and art. But play is not identical with art, because it is still too serious a matter. The boy who plays robber and police is not like an actor playing the rôle of a robber. He really is the robber so far as the advantages, the freedom, and the power of a robber are concerned; and he enjoys these advantages, while the actor does not even think of them. The actor, even while playing the rôle of a king, desires to play the king, not to be the king. Play, that is, the instinctive activity of play, is intermediate between art and life, a gateway to the former.

There are still further sources of art. After having been successful in his struggle, when he has some leisure, man observes that many things which he uses as weapons, as tools, for food, and so on, are capable of giving him pleasure quite aside from their practical significance. He therefore obtains these things for their own sake. He collects brilliantly colored feathers, glittering stones and pearls. The instinctive reactions upon pleasant experiences are discovered to be pleasant themselves. They are voluntarily repeated. Thus dance and song originate. In a similar manner, from the descriptions of ordinary life, tales take their origin. Symmetry and rhythm are discovered and become of the greatest importance for the various arts. In spite of the manifoldness of its origin and its application, we may speak of art in the singular, because all the different arts have this in common, that they give joy without serving any conscious purpose.

In every art three factors may be distinguished on which the feeling aroused in us depends: the subject-matter or content, the form, and the personal significance. If the work of art is a picture, it may represent a battle or a landscape; if a poem, the wanderings of Ulysses or the

story of the Erlking; if music, a waltz or a funeral march. This subject-matter is given a particular form or structure. The twelve disciples of the Last Supper may be placed in a simple row or arranged in groups of various kinds. A church may be built in Roman or Gothic style. Meter and rhyme differ in various poems. Music may be harmonized in many different ways. All this refers to the form of art. The third factor, the personal significance, may be illustrated by the different moods which speak to us from pictures of the same subject-matter and similar form, also by the technique chosen by the painter. The picture may appear to me as an assembly of Jewish fishermen or as an historical act in which the disciples of the Lord and he himself take part.

Much could be said about all this in detail. Some important insight into the relation of the different factors can be obtained from a discussion of the first one, the subject-matter. How does the artist succeed in giving us, through his subject-matter, pleasure independent of and free from any consciousness of purpose? Two ways are open to him. The first appears most clearly in music. It consists in using contents which play no part in the world of needs. Musical tones, sung or produced by instruments, do not contribute to the preservation of man; and therefore they do not incite our desire. However, when properly combined, they are capable of arousing the most varied and intense feelings, moods, emotions. They are thus especially adapted to serve as material, as contents, of a work of art.

The second way open to the artist consists in imitation. It prevails in painting and sculpture, and one may say also in poetry. The contents of these arts, that is, the subjects described, are indeed things which arouse our desires.

But the desire is cut short through imitation. Not the real things, but only descriptions of them, are furnished us. Their affective value is not diminished thereby. It is true, the feelings depending on the consciousness of purpose are lost; but the rest of the feelings attain thus a purity and intensity all the greater. We scarcely enjoy meeting a robber on the highway; on the stage or in a novel we enjoy it the more. The real rug gives me feelings of a mixed kind when I think of its price and its durability; the painted rug gives me only pleasure. Since imitation is so conspicuous in the three arts of painting, sculpture, and poetry, it has been mistaken to be the aim of our artistic activity, whereas it is only a means to an end, to the production of pleasure free from desire. To understand this still more clearly, we must give attention to three aspects of the problem of imitation.

First, imitation must be as true to nature as possible. Feelings are to be aroused. These feelings are originally attached to the real things. It is clear, then, that they will be aroused the more readily, the more similar the work of art is made to reality. A disagreement with nature causes not merely a weakening of the pleasant feeling, but an unpleasant feeling, a protest against the artist's intentionally disforming nature or against his incapacity.

Secondly, imitation must never become a perfect duplicate of the real thing, to be mistaken for it. There must be no deception of him who enjoys the work of art, for deception would result in unpleasant feelings. Therefore we separate a picture from its surroundings by a frame, place a statue on a pedestal, let a drama be played on a stage.

Thirdly, devotion to imitation must not lead the artist to neglect the other properties of the work which make it

significant for our life of feeling. A work of art is always a compromise. Nature gives us not only what is significant, but also what is insignificant or even disgusting. The subject-matter must therefore be worked over ; that which is of positive value must be emphasized, even exaggerated. Nature usually presents a confusing multitude of details. Mind, for its enjoyment, needs a unitary structure made up of a multitude of details. The artist therefore must, whenever this is necessary, reconstruct nature in order to insure unity of perception. Imitation must often be adapted to special circumstances. A lion among allegorical figures as a symbol of might cannot be represented as an exact imitation of the lion of the desert. The real lion is a dangerous beast, a big cat. The symbolical lion must agree with a certain traditional style. Nature is replete with the insignificant, the individual, the momentary ; mind longs for the significant, the general, the eternal. The highest art is found where the artist has been able to reach a maximum of the total effect of all the simultaneous factors.

Religion would be more easily understood, were it not for the many forms under which the single need is satisfied according to circumstances. Art, too, would be more easily understood, if the factors contributing toward the same end were less numerous. Each of them is regarded by some as the essential or exclusive basis of art. It is not difficult to explain this. The people at large naturally take most interest in the subject-matter, perhaps also in the technical ability of the artist. The musician, knowing that form is the main factor in his art, is apt to generalize and to regard form everywhere as the essential element. The painter or sculptor — observing how other artists give artistic values to the most varied subjects, perhaps feeling

himself able to raise any subject, however selected, into the realm of art—may be inclined to think of art as an institution for the employment of the creative energy of those whose talents tend in this direction. Each one gives attention to that aspect of the whole problem which especially concerns him. He overlooks its other aspects.

Not every species of art permits an equal development of all the different factors of art in general. For example, in handicraft and in architecture the work as a material thing serves a practical purpose; as a work of art it serves esthetic enjoyment. The form is here largely determined by its practical applicability. Its purpose must not be hidden, but appear as clearly as possible. Mind must here force itself to disregard the purpose and to enjoy the work independent of its practical interests.

When mind has thus been trained to look for esthetic values, even where the practical side of the thing is paramount, it becomes able to enjoy esthetically even that which in no way directly suggests an esthetic attitude of the spectator. Man learns to enjoy the beauty of nature as something independent of his practical needs. This ability has grown very slowly. As late as the end of the eighteenth century one reads in a book on Switzerland in a description of the Engelberg valley the following words: "What do you see? Nothing but horrid mountains; no gardens, no orchards, no wheat fields pleasing to the eye."

One thing assisting in this esthetic liberation of the mind is the many-sidedness of nature in comparison with the practical interests of man. Every one can find in nature something remote enough from his everyday interests to become an object of esthetic enjoyment. We enjoy reading about a war in the far East, not only because we recall that we have no money invested there and



nothing else to risk, but chiefly because the feelings aroused by the reports from the theater of war can develop without interference. They could not, if the battle took place in a neighboring village. For the same reason we enjoy travel esthetically, not when we are compelled to travel, but when we choose it for our recreation. Standing in the market place of a foreign city, I see the people talk, gesticulate, bargain, as they do in my own town. And yet it is different. There are no relations to my own domestic affairs. Their talking does not concern me. I do not even understand their language. Thus I am able to enjoy the sight esthetically. It is true that nature rarely fulfills all those conditions which the artist fulfills in a work of art by his artistic reconstruction of the piece of nature represented by him. But this loss of esthetic effectiveness is compensated by the inexhaustible variety, the never ceasing movement, the immense power and magnitude of nature.

Thus mind turns against its own beginning. But not in order to make war upon itself, but to overcome evils of former adaptations by a new and higher kind of adaptation.

### QUESTIONS

223. What property is common to works of art of every kind?
224. How does religion contribute to the growth of art?
225. How is play related to art?
226. What are the three factors in art on which our feelings depend?
227. Which of the three factors is predominant in music?
228. What is the advantage of imitation over reality?
229. What are the three aspects of the artistic problem of imitation?
230. What training does the mind receive from the enjoyment of handicraft and architecture?

231. What kind of esthetic enjoyment has developed most recently?

232. How does nature assist man in the highest development of his esthetic ability?

## § 26. MORALITY

What remedy does mind discover for the third class of evils, those resulting from its own activity for other members of society, and those resulting from the restlessness, the protestation of the latter? The remedy is essentially a social phenomenon, and can be discussed here only very briefly with respect to the individual mind.

Mind learns to appreciate and to train itself for activities contributing directly to the welfare of society as a whole by actually working for the good of others rather than for its own good. When the social group increases in size, the more experienced and provident members recognize, not by logical reasoning but as the immediate result of experience, that brutally egotistic acts give rise to quarrel and distrust, weaken the ties which hold together the members, and make the group the prey of its enemies. Altruistic acts, on the other hand, are found to strengthen the group. These influential members then endeavor to further the latter and to suppress the former kind of actions. There are two possible ways of bringing this about.

First, compulsion. Acts destructive to society are punished. He who commits them thus suffers a disadvantage much greater than the immediate advantage, and the consciousness of this probability of suffering inhibits the act. The total concept of activities or inactivities enforced by punishment is the law. But the law is not far-reaching enough. A society of wholly wicked beings cannot be held together by law. Faith and loyalty cannot be enforced.

Willing may consist in a consciousness of the immediate act or in a consciousness of the remotest purpose to the realization of which this act contributes. If in consequence of threatened punishment I will the required act, but not its ultimate purpose, I can frustrate the latter in a hundred different ways. To punishment, therefore, must be added a second means of furthering the welfare of society, through actions of free will. The performance of acts of this kind is called morality.

The special form of morality anywhere at any time depends obviously on many circumstances. It is conceivable that in a tribe sparingly endowed with natural resources and pressed by enemies, morality may demand the killing of the aged and of female children. On a higher level of culture such actions must be immoral, because they do not harmonize with other moral commandments, or because, when food is plentiful, an increase in numbers is highly desirable. The Catholic church regards divorce as immoral, but in Japan public opinion regards the enforced continuation of the matrimonial tie as immoral. It is obvious that morality is a growth. But it grows very slowly, remaining nearly constant for long stretches of time; and so we often meet moral commandments which no longer fit the people upon whom they are imposed.

Kant has more strongly than any one else taken the opposite view. Morality, according to him, is something definite, eternal, absolute, not dependent on circumstances — categorical, as he calls it, not hypothetical. How can this doctrine be reconciled with what we have said above?

We mentioned that actions benefiting the total social group are not the result of reflection, of reasoning, but the immediate result of experience on the part of the most provident and most influential members of the group.

Errors and superstitions naturally play their part in the formation of the first moral rules. But subsequent experience gradually improves them, so that they soon become of real benefit to the whole society. How are these rules then transmitted to following generations? By impressing them upon the child. Young children can be given commandments; but explanations of their purpose would in most cases be useless. They are therefore given categorically, as imperatives supported by the authority of parents, elders, priests. Under these circumstances, of course, it is not to be expected that the children will later recall any purpose when they become conscious of these rules. The rules appear in their consciousness as something unconditional, absolute—in their totality as *conscience*.

One may here raise this question: Why does not society, after its children have grown into men and women, inform them of the purpose of these rules? This information is not given partly because society as a whole is not clearly conscious of the purpose, partly because it is better to leave to these rules their absolute character. The commander of an army does not explain the purpose of an order sent to an inferior officer. This has its disadvantages in so far as the latter, knowing the purpose, might improve details of the order which the commanding officer, from his distant position, could not properly adjust to the actual conditions. But on the whole it is preferable to require strict adherence to the order and not to permit reflection before its execution, for reflection might easily give room to thoughts of self-preservation. Similarly, society demands absolute obedience because thus, on the whole, the moral rules are more strictly carried out, with greater benefit to society. Nevertheless, the rules have their justification only in their pur-

pose, the welfare of society. And conflicts between the literal commandment and this purpose are by no means rare. The white lie, for example, has given much trouble to moral theorists. To the unbiased moral consciousness it is in innumerable cases the proper act. What commander of an army could be tolerated who would refuse to deceive the enemy? How could we meet children, the sick, the insane, if we had made up our minds never to tell a lie?

Understanding the value of the (apparent) absolutism of the moral rules, we also understand why moral sentiment is so highly estimated as compared with a mere number of correct acts. Moral sentiment is the only reliable source of correct action. If we judge a person exclusively or mainly by his success in correct activity, we are likely to discourage his attempting a difficult task. In order to give the greatest possible encouragement, we tell him that it is his free will to do good that determines our estimation of his social value, no matter whether he succeeds or not. However, the question whether a man's will is to be called good or bad, can be answered only by pointing out a social purpose, the furtherance of the welfare of the whole. Without this the will to do good, the feeling of duty, is like the rope by means of which Münchhausen descended from the moon.

The absolutism of morality explains the close relation of morality to religion. Religion, morality, and sometimes political law, are under God's protection; the laws of reasoning and of artistic creation are not. The latter are also gifts of God, but left unprotected. Error and bad taste are no sins. Religion, if without direct protection by threatened punishment, would be found by each individual; but each would find a different one, and since only

one religion is supposed to be the true one, uniformity has to be enforced by threats. Morality still more needs protection by threatened punishment coming from God, since individual desires differ greatly, and would never give rise directly to uniform moral rules. These rules are the product of the experience of generations, and always meet with more or less resistance from the individual. Human authority is frequently not strong enough to overcome this resistance. So God's protection is needed—and found very easily. What can a father reply to his ever questioning child: Why must I give away a part of what I like to keep myself, or tell what I shall be punished for? He gives the same answer which he gives to the question who made the horses and the whole world: "God made these rules." Perhaps it would be best if the child were always told that God did not impose these rules upon man as something foreign to his nature, simply because God capriciously chose to do so; but that he gave man these rules because they are needed for the highest development of human life. Only a will which acts morally because this significance of morality is understood can be said to be truly free.

We have frequently spoken of communities, of groups of human beings. Now, man belongs to many communities at the same time: family, town, state, nation, friends, the profession, the denomination, and so on, up to mankind as a whole; which one is meant? They are all meant, but so that in case one obligation excludes another, the one toward the narrower circle of associates takes precedence. We do not approve of women devoting to charity what they owe to their children. But where the narrower circle leaves us free from obligation, the wider circle claims us as its subjects. One of these circles, the

widest of all, is mankind ; but morality did not begin with recognizing this. Only those are permitted to enjoy the benefits of one's morality who are clearly felt to belong to the same community. The expansion of political, linguistic, religious communities enormously increases the number of individuals toward whom each, one feels moral obligations.

But this expansion alone would not have broken down the barrier between one and all the rest of mankind. This barrier has been removed by the acceptance of monotheism. Other factors may have contributed toward this result. The categorical character of the moral rules, their independence of conditions, must have favored their universal application to any human being. The development of the idea that all human beings are essentially alike, and of the idea of the unity of the world, must have greatly strengthened the universality of the moral rules. The development of the moral ideal, as we saw, tended to unify the conception of God. But this conception of a single God, monotheism, then gave a new impulse to the universal application of the moral rules. When each people has its own god, his commandments are valid only to his own people. But when it is recognized that only one God exists, his commandments can hardly be confined to the territory of one people. Plato and Zeno, accepting this consequence, teaching that human beings are like the members of one flock, introduced a doctrine new to the Greeks. Christ, reciting the Mosaic law, "Thou shalt love thy neighbor, and hate thine enemy," adds to it: "But I say unto you, love your enemies, bless them that curse you, do good to them that hate you," and thus takes the decisive step. But mankind is still far from having accepted this doctrine completely. To plunder private prop-

erty on the high seas in time of war is no longer regarded as meritorious, but scarcely begins to cast shame on him who makes himself guilty of it, as plundering on land does.

## QUESTIONS

233. Why is acting by free will superior to willing under compulsion?

234. What philosopher is mentioned in the text as the chief opponent to the doctrine that morality is a growth dependent on circumstances?

235. How and by whom were moral rules first discovered?

236. How are moral rules propagated? What is the consequence of this mode of propagation?

237. What two reasons are stated for the fact that society does not inform its members of the real purpose of the moral rules?

238. Why is moral sentiment valued more highly than correct acts?

239. How is the relation between morality and religion established?

240. What is the influence of monotheism on the growth of morality?

## CONCLUSION

What a strange being is man according to popular understanding! He possesses senses intended to inform him of the world, but incapable of doing this since they deceive him. In addition he has judgment and reason which help him to discover the deceptions of his senses and to gain a true knowledge of the world by the aid of principles whose origin is foreign to this world. His thoughts consist of ideas which succeed each other in accordance with definite laws. Nevertheless, he sits within himself, the *homunculus* in the *homo*, and with perfect contempt for those laws directs the ideas, weakens this, strengthens that, keeps one and expels the other, unites



them and separates them with despotic arbitrariness. His chief desire is furtherance of his well-being. Nevertheless, he strives to aid others, to be fair and just, to mortify the flesh. He unceasingly strives to make himself the lord of the world. Still he has a constant craving for being the subject of an omnipotent power; and to satisfy this craving God has given him the belief in Divinity. But God, from whom everything springs, has given him also a punishable inclination toward heresies and confused him by the contradictions of a hundred different revelations, each one claiming its own genuineness. Man's whole being appears mixed up. No second step is possible without reversing the first. No definite purpose can be made out in all this.

Yet man becomes comprehensible as soon as we apply scientific methods to the study of his nature. He has indeed numerous faculties, seeing and hearing, imagination and feeling, reproduction and concentration. These, however, do not oppose each other, but stand side by side, supplementing each other, as everything on earth consists of parts which supplement each other. The fundamental laws of human life are the same as those which we find in the higher animals. But man's ability to elaborate momentary sense impressions is immensely increased: there is no limit to the associative and selective combination of the elementary impressions. Thus man establishes his power over all other animals and the inanimate world, realizing the general purposes common to all organisms by incomparably higher and richer constructions. But these, however we esteem them, are derived from the same fundamental forces of nature, only differing in measure and in their proportions. Mind is not like an unclean pot in which noble seeds are planted, so that the plants growing

from them do not fit the vessel containing them and unending discord must result. Mind is a unitary organism which, unfolding its capacities, adjusts itself more and more perfectly to the circumstances of chance or of its own creation. As the same atmosphere brings forth out of wind and water and warmth now fertile rains, now destructive hail storms, beautiful clouds above, dangerous fog below, so the same mind by the same natural laws brings forth error and truth, desireful pleasure and desireless joy, selfishness and morality.

# INDEX

- Abstraction, 126, 133, 140, 151.
- Adaptation, 74.
- Affection, 162.
- Afferent, 35, 38.
- After-image, 74.
- Anemia, 27.
- Animals, 27, 37, 65, 75, 128, 151, 197.
- Apes, 27.
- Apperception, 119.
- Arborization, 33.
- Architecture, 202.
- Aristotle, 3, 10, 17.
- Art, 14, 24, 196.
- Association, 10, 11, 12, 14, 93, 144, 164.
- Attention, 11, 12, 87, 115, 121, 125, 144, 151.
- Audition, 74, 76.
- Auditory, 62, 98.
- Automatic, 101.
- Axiom, 152.
  
- Beats, 64.
- Beethoven, 14.
- Belief, 152, 156, 158.
- Bessel, 20.
- Biology, 16.
- Bismarck, 180.
- Blind born, 67.
- Boycott, 136.
- Brain, 21, 22, 23, 27, 28.
- Brewster, 17.
- Broca, 21.
- Buffon, 11.
- Bulb, 38.
  
- Cæsar, 136.
- Catholic church, 205.
- Causality, 5, 7, 8, 9, 177.
- Center, 35, 36, 37, 107, 111.
  
- Cerebellum, 38, 39.
- Cerebrum, 38, 41.
- Christ, 209.
- Cicero, 159.
- Coherent thought, 142.
- Collateral, 32.
- Color, 58.
- Color-blind, 60, 76.
- Color mixture, 61.
- Conduct, 162, 176.
- Conscience, 206.
- Consciousness, 41.
- Conservation of energy, 45.
- Copernican system, 161.
- Cortex, 38, 40, 41.
- Corti, 76.
- Crime, 97.
- Cutaneous, 52, 73.
  
- Davy, 121.
- Definition, 141.
- Dendrite, 31.
- Desire, 109.
- Determinism, 181.
- Difference tone, 64.
- Discrimination, 100.
- Distance, 116.
- Dream, 142, 156.
- Drugs, 27.
- Duration, 68.
  
- Education, 24, 97.
- Efferent, 35, 38.
- Emotion, 168.
- Enlightenment, 11.
- Esthetics, 14, 185, 197, 202.
- Evolution, 5, 16.
- Experiment, 17.
- Expression, 105, 169.

- Faculties, 10, 11, 13, 22, 124, 151.  
 Falstaff, 123.  
 Fatalism, 179.  
 Fatigue, 102.  
 Fechner, 18, 19.  
 Feeling, 81, 162.  
 Fibril, 32.  
 Fichte, 15.  
 France, 10.  
 Frederick William, 1, 5.  
 Freedom, 7, 8, 9, 176, 208.  
 Fritsch, 21.  
 Future life, 192, 195.  
  
 Galileo, 10.  
 Gall, 29.  
 Ganglion cell, 30, 32, 38, 80.  
 Generalization, 126, 128, 134.  
 Goethe, 14, 62.  
 Gray matter, 33, 39.  
 Greece, 192.  
 Greenwich, 20.  
  
 Hallucination, 79.  
 Handicraft, 202.  
 Harmony, 68.  
 Helmholtz, 17, 76.  
 Heraclitus, 3.  
 Herbart, 12, 13, 14, 18, 19.  
 Herod, 137.  
 Hitzig, 21.  
 Hobbes, 8, 9, 10, 17.  
 Hume, 10.  
 Hypnosis, 179.  
 Hysteria, 29.  
  
 Ideation, 123.  
 Illusion, 120.  
 Imagery, 98, 128.  
 Imagination, 78, 115, 124, 151.  
 Imitation, 130, 132, 199.  
 Indeterminism, 181.  
 Insane, 143.  
 Instinct, 85, 91, 101, 107, 109, 110, 130, 171, 173, 180, 197.  
 Intelligence, 27, 148.  
 Interest, 89.  
  
 James, 170.  
 Japan, 205.  
  
 Jewish prophets, 193.  
 Judgment, 142.  
  
 Kant, 13, 15, 205.  
 Kinesthetic, 51, 52, 67, 86, 91, 98, 108, 117, 129, 131, 145, 174.  
 Kinnebrook, 20.  
 Knowledge, 152, 157, 184, 189.  
  
 Labyrinth, 54.  
 Lange, 170.  
 Language, 3, 24, 109, 128, 144, 147, 151, 155.  
 Latent idea, 81.  
 Laughing, 105.  
 Law, 24.  
 Leibniz, 8.  
 Linnæus, 11.  
 Literature, 139.  
 Localization of function, 41, 42, 44.  
 Lotze, 19.  
  
 Machine, 15.  
 Maskelyne, 20.  
 Mathematics, 13.  
 Medulla, 38.  
 Melody, 68.  
 Memory, 92, 123, 144, 149, 150. /  
 Metaphor, 137.  
 Metonymy, 137.  
 Middle Ages, 7.  
 Mind, 47.  
 Money, 165.  
 Monotbeism, 193, 209.  
 Mood, 169.  
 Morality, 193, 204.  
 Mosaic law, 209.  
 Motor point, 34.  
 Movement, 105, 108.  
 Müller, Johannes, 17.  
 Münchhausen, 207.  
 Music, 199.  
  
 Napoleon, 159.  
 Natural science, 6, 8, 9, 16.  
 Neo-Platonic philosophy, 194.  
 Nerve anatomy, 38.  
 Nerve center, 35, 36, 37, 107, 111.  
 Nervous architecture, 34.  
 Nervous process, 33.

- Nervous system, 27, 28, 36.  
 Neuron, 30, 81.  
 Newton, 10.  
 Noise, 62.  
 Odor, 57.  
 Organic sensation, 56, 170, 174.  
 Otolith, 54, 55, 65.  
 Pain, 53.  
 Painting, 200.  
 Passion, 172.  
 Pathology, 22, 117, 143, 174.  
 Perception, 105, 114, 119.  
 Personal equation, 20.  
 Perspective, 116.  
 Philonic philosophy, 194.  
 Philosophy, 18, 19, 23, 24.  
 Phrenology, 29, 42.  
 Physiology, 16, 17, 19, 21, 22.  
 Plato, 10, 193, 209.  
 Play, 106, 197.  
 Pleasantness, 82, 106.  
 Poetry, 200.  
 Practice, 99, 126.  
 Prayer, 191, 192, 193.  
 Predestination, 179.  
 Priesthood, 191, 195.  
 Priestley, 182.  
 Property, 186.  
 Psychiatry, 23, 24, 28, 143.  
 Psychophysics, 19, 23, 24, 28, 143.  
 Ptolemaic system, 161.  
 Pythagoras, 158.  
 Quantitative, 13, 17.  
 Range of perceptibility, 70.  
 Reality, 153.  
 Reason, 142.  
 Reflex, 86, 107, 110, 170.  
 Reflex arch, 36, 38, 107.  
 Religion, 14, 24, 189, 197, 207, 209.  
 Reproduction, 93, 125.  
 Responsibility, 180.  
 Retina, 73, 75.  
 Rousseau, 15, 183.  
 St. Luke, 137.  
 Schelling, 18.  
 Schopenhauer, 15.  
 Science and religion, 194.  
 Sculpture, 200.  
 Seat of the soul, 29, 41.  
 Self, 145, 166.  
 Semicircular canals, 54, 55, 65.  
 Sensation, 50, 65.  
 Sensationalism, 10.  
 Sensitiveness, 69, 73.  
 Sensory point, 34.  
 Set of the mind, 94, 123.  
 Slang, 138.  
 Social classes, 186.  
 Space, 65.  
 Spatial, 67.  
 Speech, 109, 130, 139.  
 Spinal cord, 38.  
 Spinoza, 8, 160.  
 Stimulus, 69.  
 Strümpell, 174.  
 Succession, 68.  
 Superstition, 161.  
 Switzerland, 202.  
 Taste, 57.  
 Temperament, 172.  
 Temporal, 68.  
 Tetens, 11.  
 Theology, 194.  
 Thought, 108.  
 Threshold, 100.  
 Time, 65.  
 Tone, 62.  
 Trinity, 194.  
 Truth, 152.  
 Types of imagery, 98.  
 Unity in variety, 68, 164.  
 Unpleasantness, 53, 82, 106.  
 Vision, 74, 75.  
 Visual, 58, 73, 98.  
 Voluntarism, 15.  
 Voluntary, 109, 171.  
 Weber, E. H., 17, 18.  
 Weber's law, 18, 71.  
 White matter, 33.  
 Will, 87, 91.  
 Willing, 85, 173.  
 World, 145, 167.  
 Wundt, 23.  
 Zeno, 209.  
 Zoroaster, 193.















